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ROLE OF MATURITY AND EXPERIENCE IN JUNIOR HIGH SCHOOL GEOMETRY

by

© W.C. BOBER

A THESIS

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled "Role of Maturity and Experience in Junior High School Geometry," submitted by W.C. Bober, in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The purpose of this investigation was to study the relationship between geometric maturity and geometric experience at the junior high school level. To study this relationship parallel forms of a geometric maturity measure, based on the work of Piaget and Inhelder, were administered to a sample of 422 students at an interval of 6 weeks. During the intervening period, a random sample of 6 classes with 167 students at grade 7, 8 and 9 in each of 2 school were exposed to 7 mathematics laboratories rich in projective and Euclidean geometric experiences. The schools, one being city centre and one suburban, were considered typical of those kinds of schools in the Catholic School System in Edmonton, Alberta.

The investigation sought to answer two major questions:

1. Are junior high students at the "Euclidean Level" of geometric maturity as defined by Piaget and measured by the pretest?
2. Do geometric experiences raise the students' level of maturity as measured by the postest?

To answer these questions, appropriate null hypotheses were tested in each of the two schools separately using analysis of variance procedures.

It was found that in neither school had students reached the Euclidean level of maturity. In fact, on the average the students were far below such a level. It was found that students who experienced laboratories did significantly better than those who did

not have laboratories on the postest. At the grade 9 level, students experiencing the laboratories reached the criterion for the Euclidean level of maturity. These latter findings were identical for both schools.

In testing what were considered minor hypotheses, it was found that there were no sex differences on either pre- or post-tests. It was also established that although the mean pretest scores for the two schools were significantly different, this difference disappeared on the postest for both laboratory and non-laboratory groups.

A further important finding dealt with grade level differences. It was found that for both laboratory and non-laboratory groups in both schools that grade 7 and 9 mean scores on both tests were significantly different as were the mean scores for grades 8 and 9. There was no significant difference between grades 7 and 8, although for the non-laboratory group in each school, the grade 8 students scored at a lower mean level than the grade 7 students on both tests.

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THE PROBLEM

I. Introduction

A fundamental question facing formal education is the relative roles that experience and maturity play in determining the prerequisites for learning. The point of view that the curriculum developer or teacher holds with respect to this question will be reflected in the tasks in which the learner engages in and in the timing of such engagement. For example, the teacher who believes maturity to be all important may defer any introduction of a topic until he feels certain that the student is mature enough.

This question has special importance in mathematics. For the past twenty years school mathematics has been undergoing multitudinous change. Many new topics, frequently previously thought to be too advanced, have found their way into ever "lower" levels of the school curriculum. For example, substantial instruction in Euclidean geometry has found way into the junior high and elementary school curriculums. This fact in light of the above question leads one to ask, "are such students mature enough to learn this geometry?"

A more recent "revolution" in school mathematics has involved the introduction of new instructional practices, such as mathematics laboratories. Thus the second question becomes, what do new methodologies contribute to the student's mathematical experience. The remainder of this chapter is devoted to discussing the background

to the question of the relationship between experience and maturity in school mathematics. This discussion leads to the statement of the central problem of this thesis.

II. Background to the Problem

Traditionally, geometry teachers presented fundamental ideas of space based on euclidean principles of straight lines, angles, squares, circles, the measurement of segments and angles and the like. They tended to think of euclidean geometry as the natural geometry and hence children should easily come to understand space in terms of euclidean concepts. They have strong support historically for formally it was the euclidean concepts of space that were first developed.

Piaget and Inhelder hold a different point of view. They maintain that a child does not have the same concept of space as an adult. They further state that the understanding and use of euclidean concepts is preceded first by the development of topological and projective concepts. A child progresses in his understanding of representational space in the following order: topological, projective and euclidean. (Piaget and Inhelder, 1963) They further suggest that the maturity levels are reached in sequential stages. At about six years of age, topological concepts slowly give way to projective concepts. At about eleven years of age, the child can perform simple metric operations such as the measurement of length in one, two or three dimensions; can construct metric coordinate system and demonstrate the beginning of measurement of angles and areas. The final level, the euclidean, is reached at about thirteen or fourteen

when areas, volumes and proportions are calculated. (Piaget, Inhelder and Szeminska, 1960)

An interpretation of Piaget suggests that children must undergo topological experiences, projective experiences and then euclidean experiences, and in that order to develop maturity in geometry.

III. Statement of the Problem

The problem central to this thesis can be posed in the form of three questions.

1. Have junior high students reached the euclidean level of geometric maturity as measured by a specific test of this capability?
2. Can instructional procedures be constructed which provide primitive experience with projective and euclidean geometric concepts?
3. If students are not geometrically mature, do the instructional procedures, special mathematics laboratories, contribute to growth in measured maturity?

IV. Definition of Terms

level - the term refers to one of the three psychological definitions of space - topological level, projective level, euclidean level.

laboratory - this term will refer to one of the seven experiences that the student in the experimental group will undergo in the study.

V. Delimitation of the Study

This is a study to see the relation between experience and geometric maturity. Specifically it attempts to judge the effects of

planned experience on children's measured geometric maturity. These children are theoretically geometrically mature but may not be actually geometrically mature. It involved intact classes in two junior high schools using all mathematics students of grades seven, eight and nine. Although the design of the study is quasi-experimental, there was no special way in which students were assigned to classes and no special features of any class.

VI. Experimental Setting

Two schools were selected for this experiment on the basis of similar structure of classes. One was an inner city school, the other a suburban. This sample of classes would rank as representative of those in the Edmonton Catholic System. All students taking mathematics in grades seven, eight and nine in both schools were used for the pretest and postest.

VII. Mathematics Laboratory Group

Since the placement of students in classes in both schools was not done for any purposeful reason, a random class selection from each grade was made. The laboratory program of seven activity lessons was held twice a week for four weeks in place of the regular mathematics classes. The students worked individually or in groups of two or three using manipulative materials and following written instructions. Following each laboratory session, a discussion period was held.

VIII. Control Group

The remainder of the students not in the laboratory group were used as a control group. They continued with their regular mathematics

classes. At the end of the allotted time, all students took the postest.

IX. Hypotheses

The major hypotheses tested were:

1. The students of the two junior high schools have reached the euclidean level of maturity in geometry based on the pretest.
2. There is no significant difference in the scores attained by students who have had laboratory experience and those who have not as determined by a postest of geometrical maturity.

Three other minor hypotheses were tested.

3. There is no significant difference in the scores of students in the two junior high schools based on the pretest and postest.
4. There is no significant difference in the scores at an increasing grade level as determined by the pretest and postest.
5. There is no significant difference in the scores between boys and girls based on:
    (a) pretest
    (b) postest on control group
    (c) postest on laboratory group.

X. Significance of the Problem

The study has practical as well as theoretical importance. It is designed to provide further evidence regarding the geometric maturity of junior high school students. Further, the study will examine the effect of experience on measured maturity and thus if experience might trigger the exhibition of geometric maturity. Should this be the case,

there are important implications for mathematical instructional practice.

XI. Oultine of the Report

The present chapter is an outline and preview of the study. Chapter II consists of a review of the literature relating to the study. Chapter III contains a complete description of the design and preparation of the testing instruments and the laboratory experiences. Chapter IV consists of a description of the design of the experiment. Chapter V consists of the results from the statistical analysis of the data gathered, while Chapter VI consists of a summary of the investigation, and a discussion of possible conclusions and limitations, together with recommendations for further research and educational practice.

CHAPTER II

REVIEW OF RELATED LITERATURE

I. Introduction

The present study is an attempt to see if students in the junior high schools are able to attain the third level - the euclidean level in the study of geometry. If they are not able to do this, will a concentrated and rich study in projective and euclidean transformations assist them in reaching that level.

A study of the above problem described is dependent upon certain theoretical, measurement, and pedagogical developments. A theoretical base relating to the problem is Piaget's representation theory and the Piagetian school's view of the development of geometric notions in children. In order to relate this theory to the problem described, a testing scheme reflecting geometric maturity is needed. Given certain test outcomes a sequence of mathematics laboratories based upon certain geometric and pedagogical principles will be executed. Thus it is the purpose of this chapter to develop a framework for the tests and laboratories related to the theoretical notions which will be reviewed first in some detail.

In addition research will be reviewed relating the effect of experience on the development of representation space. This chapter will conclude with a framework for the current study which will serve as a summary for the chapter.

II. Piaget's Three Levels

Geometry presented to children is structured on the assumption that a child's first concept of space is euclidean but Piaget maintains that this assumption is incorrect. (Copeland, 1970, p. 148) Piaget and Inhelder state that the understanding and use of euclidean concepts is preceded first by the development of topological and projective concepts. A child progresses in his understanding of representational space in the following order: topological, projective and euclidean. (Piaget and Inhelder, 1963)

The first of these concepts of space that a child can represent to himself in thought, are those that deal with characteristics of external reality such as:

1. proximity or nearbyness
2. separation
3. order of spatial succession.

   This appears when two neighboring though separate elements are ranged one before another.

4. enclosure or surrounding

   In the series $\angle ABC$, the element B is perceived as being between A and C which form an enclosure along one dimension. In three dimensions, enclosure forms the insideness as demonstrated by an object in a closed box.

5. continuity

   In the case of lines and planes, there is a relationship of infinite extension or continuity.

These relations of proximity, separation, order, enclosure and continuity are built up between the various parts of figures or patterns. Pupils at this level are unable to conceive features such as distances, straight lines, and angles during changes of shape. The topological features mentioned above are purely internal features and this makes it very difficult to relate other figures and so the only type of relation formed may be a one-to-one correspondence relation. Therefore, topological transformations only furnish the basis for an one object analysis. Mathematically speaking, topological transformations are based on an advanced level of theory; however these transformations rest on very easy modes of perception from which the small child can most readily form his first elementary spatial representations. (Holloway, 1967, p. 3)

In projective space, objects are located relative to one another although there is no measurement. Projective space begins, psychologically, when an object is considered from a point of view and in relation with other objects. An object is envisaged not from the surface or from the interior, but from a more remote vantage point, so that the observer now occupies a position from which he perceives the object as it looks from that particular viewpoint. Different viewpoints give rise to the variations in the size of objects. These points of view or relations of the observer to the object represent a perspective relationship. Perspective is a part of projective geometry. Also involving a point of view in projective geometry is how one object would look if projected on another. No consideration is given to parallel lines and the measurement of angles and segments.

The final stage is the development of euclidean space. Three levels of achievement are distinguished in the construction of euclidean space. The first level would involve various kinds of conservation: conservation of distance and of length, of area and interior volume, and conservation of congruences. The second level would include simple measuring operations: measurement of length in one, two or three dimensions, the construction of metric coordinate systems and the first beginning in the measurement of angles and areas. The final level would be the calculation of areas and volume: a conservation of area and volume relative to the surrounding spatial medium.

Therefore, maturity at each of the levels according to Piaget generally represents a movement, by these three stages, away from egocentricity.

III. Representation Theory

To understand the development of the three stages of the concept of space as given by Piaget and Inhelder, we must look at Piaget's Representation Theory. (Piaget and Inhelder, 1963) To understand his theory, let us distinguish the difference between perceptual space and representational space. A child sees a railroad track, a garden fence; he recognizes each when he encounters it in his environment. He may not, however, be able to construct these, for in Piaget's experiments, a child drew parallel lines for the rails of the track; fence boards of equal heights and the walls of the house of the same height in spite of the fact, he saw the rail track disappear and the fence get smaller. (Piaget and Inhelder, 1963, p. 173) This illustrates

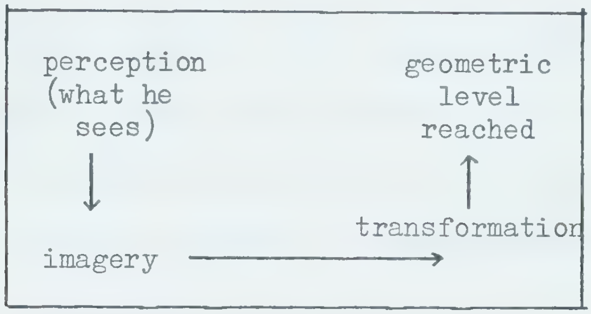
that there is a difference between what a child sees (perceptual space) and what he draws (representation space), for a child draws what he knows, not what he sees. In terms of maturity, this means the child cannot transform the reality of the object. Development of representational space does come about with maturation and experience. Piaget states that spatial relationships are not understood by the child until maturity at the particular conceptual level is reached because the structure of the human mind determines the thought that the mind can adopt. The full representational space of euclidean geometry cannot be reached until the stage of imagery based on euclidean representational thought is reached. This requires a construction and transformation of spatial relationships. It is the actions that are actually performed on the objects or figures that bring this about. Copeland stated this when describing Piaget's work:

> To know an object or event is not simply to look at it or hear about it and make a mental copy or image of it. Knowledge is not a copy of reality. To know an object is to act on it, to modify it and, in the process, to understand the way the object is constructed. Such an act is called an operation. An operation is the essence of knowledge. It is an interiosized (mental) action that modifies the object. (Copeland, 1970, p. 13)

To define what Piaget means by "action", Copeland states:

> The logical mathematical experience in contrast comes not from the object or objects themselves but from the action of the learner on the objects. For example, a child under seven is given a set of pebbles and asked to place them in a row. He is asked to count them in one direction and then in the other. He then places the pebbles in a circle and counts in one direction and then the other. He then tries another arrangement. He discovers that the sum is always the same and is independent of the order. He discovers a property of the action of ordering . . . (Copeland, 1970, p. 17)

In order to understand euclidean spatial relation, the child must possess the particular class of transformations known as rigid transformations; for projective geometry, you need projective transformations and for topological geometry, the topological transformations. This process of perception and representation can be illustrated by this model:



Piaget stresses that children cannot visualize and possess these transformations until they have seen them performed. Thought can only take the place of action on the basis of the data that action itself provides. Experience and maturity in a good cultural environment can greatly aid the development of the imagery and transformations needed for the child's concept of space.

IV. Rationale for a Testing Instrument

In order to determine the level of representation space of the child an instrument must be devised. Such an instrument must measure the transition from the projective to euclidean level. It must contain the two transformations characteristic of projective and euclidean levels. The first transformation must be a projective one - an object must be considered from a particular viewpoint. The action performed

by the person must be therefore a shifting of points of view in the exterior space. These points of view or relations of the observer to the object represent a perspective transformation. The second transformation must be euclidean - it must involve movement and a discovery of the relation of the sides of the figure so formed. This would involve rotation and translation which are characteristic of the euclidean level.

Based on these transformations, Piaget and Inhelder suggested such an instrument. (Piaget and Inhelder, 1963, chapter 9) They suggest that sectioning of geometric solids equally apply to both projective and euclidean geometry. They go on to explain that a conic section could be formed by interrupting a cone of light with a screen. This would make it a projective section. Cutting a solid cone with a knife would make it an euclidean section. Thus operations on sectioning could be of two kinds:

1. geometry of objects
2. geometry of viewpoints.

In geometry of objects, an observer must make measurements of segments and angles by passing around the periphery of an object or passing from one object to another. It brings about movement or displacement which is characteristic of euclidean geometry. In the geometry of viewpoints, the object is observed from a remote vantage point, so that the observer now occupies a position from which he perceives the object as it looks from that particular point of view.

> In sectioning solids, the closest possible interaction is apparent at all levels of psychological development, between euclidean operations which traverse a solid by an actual movement (like cutting the plasticine), and the projective operations which represent the solid according to a given perspective, cutting the three dimensional figure along a plane. (Piaget and Inhelder, 1963, p. 249)

Therefore, "the section of a solid" will refer to the boundary of the plane surface formed by the intersection of a plane with a solid figure. To section a solid consists simply of looking at objects made of wood and predicting the shape of the surface produced when the solid is cut by various planes with a large knife. (Piaget and Inhelder, 1963, p. 248) It is a question of causing an imaginary plane to pass through the object. The subject must predict the boundary or edge of the surface formed by the hypothetical cutting. The student would therefore have to select a particular viewpoint and then examine the plane figure formed, noting the size of the angles and the relationship of the sides. A sphere cut in two, yields a flat surface whose boundary consists of a circle. A right cylinder cut longitudinally yields a surface whose boundary is a rectangle.

This type of instrument has been used by Boe (1966), Davis (1970) and Palow (1970), the extension of whose work occurs later.

V. Rationale for Laboratory Experience

One of the basic requirements for the development of projective and euclidean representational space, is action performed on objects or figures. This can best be fostered by providing experiences for the child rich in projective and euclidean transformations. The specific characteristics of these experience are given.

1. Projective space considers a point of view outside the object. This was done by the projection of shadows, which follows the same laws as the projection of objects on a plane perpendicular to the line of regard and is governed by the same laws as perspective. The child has to make the comparison of his viewpoint as the source of light, shape of the object and its position relative to his viewpoint and the paper which acts as the screen.
2. Next, the experimenter must develop a transformation of viewpoints. Although there are an infinite number of viewpoints, five are basic: horizontal east, horizontal west, horizontal north, horizontal south and overhead vertical. These viewpoints considered position of objects relative to one another and the relation of before-behind and left-right.
3. The projective viewpoint must be translated into movement. This movement would consist of the intersection of a plane with a three dimensional object and a movement around the periphery of the plane object. This would be the beginning of the euclidean level.
4. Euclidean transformations must conserve length. This means that the length of segments remain constant under euclidean transformations.
5. Euclidean transformations must conserve the size of angles.
6. Parallelism and proportions are essential in the development of euclidean space. Similarity of inscribed triangles is based on the parallel nature of their sides and the equality of the measure of their corresponding angles. This comparison of angles in a

triangle is extended to other figures.

7. Euclidean space must have a horizontal and vertical coordinate system.

A child must experience these seven basic notions in projective and euclidean space. It is good pedagogy to provide an environment in which students try things out for themselves and find their own answers. A good experience of this type is a laboratory setting which has the following features:

1. The learner must be actively engaged in doing the mathematics; he is not a passive learner.
2. Concrete materials and tasks are used to give meaning to the concepts developed.
3. The student may work individually or in small groups from written instructions. (Vance, 1968)

VI. Review of Literature

The literature will be examined on three questions central to this study: agreement or disagreement with the three levels of geometry development; ability of students to reach these levels, especially the third level at certain stages measured by their chronological age; use of experiences to increase the rate of attainment of these levels.

Rivoire (1961) conducted experimental research on children from four years to fourteen years eleven months. Her test instrument consisted of twenty-eight items, seven per space - on topological, projective, affine and euclidean space. She states:

> For projective space, the total number of items passed shows an increase through the eight year level, a plateau and additional development between the ages of twelve and fourteen. (p. 64)

> Euclidean space totals are low through the eight year olds, increasing for the ten and twelve year level, and increase noticeably at the fourteen year level. (p. 67)

> The Euclidean concepts, according to Piaget, should start to develop at six and be completed by the age of fourteen. According to this study, euclidean concepts appear above chance level for the first time at the ten year level. It would appear that these concepts were not completed by the end of the fourteenth year. (p. 68)

> . . . the concepts of sections of geometric solids are not fully developed in all fourteen year old children in this study. This result does not correspond to the Piaget finding that by the age of thirteen or fourteen years these concepts are fully developed. (p. 87)

Rivoire's study revealed an agreement with the sequential development of topological, projective and euclidean stages. These concepts however were not in possession of children by the age of fourteen years.

Palow (1970) made a study of the ability of public school students to visualize particular perspectives of selected solid figures. He assumed that representational space developed psychologically through the mathematical phases of topological, projective and euclidean space in that order. His main hypothesis was to test the ability of students to imagine the cross-sections of various solids before cutting the solid. Palow extended the cross-sectioning experiment to a projective one and developed an instrument to test it. The instrument consisted of photographs of solid figures with an arrow indicating the perspective from which the student was to view each solid. The student had five choices for each viewpoint indicated by the arrow.

The experiment was done on 1067 students in classroom groups of thirty each.

Palow's analysis of covariance showed that Piaget seemed to be correct in his postulation that the ability of students to score well on the instrument increased with chronological age. This particular sample had the ability to visualize the cross section formed at an age of twelve years. Further conclusions reached were that boys scored better than girls at the .05 level of significance; the higher I.Q. group had an advantage over the lower I.Q. group and the three socio-economic groups showed no significant difference.

Dodwell (1963) performed a series of replicative experiments from "The Child's Conception of Space" using 194 children. One of the experiments was on the geometric sections. Dodwell asked the students to imagine the cut made on one of the geometric solids. He then actually performed the cut after the subject responded. Children 5 years 11 months to 11 years 3 months were used in Dodwell's sample. This age range encompasses the period when drawing ability is developing, and the ability to draw is very important in making the responses in representational space.

Dodwell concurred with Piaget and Inhelder's hypothesis on the development of representational space. In his sample, 95 children were in one of the three well-defined stages of development and 99 were classified as mixed. He concluded that the mental construction of a section is not an all-or-nothing affair, i.e. constancy from one situation or object to another is comparatively exception. (p. 152) He found a high correlation between achievement in the geometrical

tasks and age and an even more marked correlation with mental age. (p. 155)

Boe (1966) replicated an experiment on sectioning of geometric solids on a sample of 72 random selected subjects from grades eight, ten and twelve from 5 different schools. A 3 x 3 x 2 analysis of the data was performed based on grade level, mental ability level and sex. Boe used two forms of response, drawing of figures and multi-choice on her sixteen item test which consisted of four types of cuts on four kinds of solids. She found that the sample was unable to appropriately respond to all sixteen sections using either drawing or multi-choice. Only 10 of the 72 subjects appropriately responded to all sixteen sections; seven of these subjects had appropriately drawn all sixteen sections, three had correctly selected all sixteen sections; no one received a total response score of thirty-two on both test 1 and test 2. The degree of success did not concur with Piaget and Inhelder's conclusion, for ninety-one per cent did not appropriately draw the boundary and ninety-six per cent did not select the correct representation boundary for all items. Mental imagery may not be as highly developed for this age group as Piaget's observations would imply. Grade level, as a measure of age, was not a significant main effect. No improvement was evident in spite of the fact that no grade had perfect mastery of the tasks. Her study shows that ability levels appear to play an important role in the child's responses to the sectioning tasks while age level was unconsequential.

Davis' (1970) study was a modification of that of Boe's in which

he used only the sixteen multiple-choice item test based on the same four cuts on the same four solids. There were four differences in his study from that of Boe's: (1) the students underwent work periods designed to provide experience in cross-sectioning of irregular shaped objects; (2) there was a sample of 90 instead of 72; (3) students selected were from grades six, eight and ten; (4) a dialogue between the researcher and individual student was developed in regards to the test format.

Davis' research showed that age was a significant factor in the development of the ability to visualize cross-sections. The statistics for grade eight and ten generally supported Piaget's hypothesis that children of twelve years of age can visualize the conic sections. His results indicate that cross-sections may reasonably be utilized in mathematics programs provided students have a prior opportunity in the actual sectioning of solids.

VII. Summary

Piaget states that a child progresses in his understanding of space in the following order: topological, projective and euclidean. Rivoire's study (1961) revealed an agreement with this sequential development of topological, projective and euclidean stages. Dodwell (1963) concurred with this development of representational space but states it was not a clear cut development. More than half of his sample did not fit into well-defined stages of development. Lovell (1959) agreed with the stages but found a greater variability in performance within an age group than Piaget and Inhelder.

Piaget and Inhelder hypothesized that the successful accomplish-

ment of sectioning geometric solid figures implies the first step in the development of euclidean space from projective space. In their experiments on the geometric sections, they devised tasks based upon the child mentally performing a verbally described transformation upon a seen object. The child sees the object, mentally sectioning it, imagines what the shape of the surface formed resembles and concretely responds to this image. Two methods of response were used, drawing of the boundary and selecting a representation from pre-drawn boundaries.

Palow (1970) used the second response technique on cross-section of various solids. His study concurred Piaget's statement that at age of 12 the child reaches the first stage in euclidean geometry. Davis (1970) showed that age was a significant factor in the ability to visualize cross-sections. Boe (1966) disagreed. Her sample was unable to respond appropriately to the sixteen sections.

Imagery is an important component of representation space. Piaget emphasizes the importance of imagery in cognitive development. Imagination is stimulated by experience. Piaget and Inhelder support this when they say that the child must construct

> . . . a system of intellectual operations if he is to be able to form a mental image corresponding to his perception. (1963, p. 242)

The child who has not manipulated a sphere in the form of a ball or orange, who has not experienced the physical operation of cutting an orange, or of seeing an orange cut, will find it difficult to comprehend the sectioning of a sphere. Experience is necessary. The subject must be active, must transform things, and find the structure of his

own actions on the objects. (Duckworth, 1964, p. 496-499) This is the basis of the formation of the seven laboratory experiments. This is supported by Dienes (1964, p. 104) when he speaks of the importance of imagery manipulation. He believes that no abstraction occurs unless transformations are done on the imagery. Lovell (1961) showed that adolescents and young adults from a stimulating background were, in ability to categorize and form fresh concepts, superior to those from less favourable backgrounds. Isaacs (1961) in his work reviewing the main lines of Piaget's work states:

> . . . the intellectual development of young children can be fostered by education in the light of Piaget's findings, by deliberately providing situations which are optimal for learning rather than merely, 'normal' or typical of the everyday world. (p. 33)

Davis' study (1970) showed that a rich experience does increase the ability of students to visualize the sectioning of solids.

This study attempted to go beyond that mentioned above in the following ways:

1. It replicated Boe's experiment using 4 more wooden objects and both types of responses on a pretest and postest in the Edmonton area.
2. It used two junior high schools, with intact but heterogeneous classes, which are characteristic of those in the Edmonton Catholic School System.
3. It extended the practice session used by Davis, to 7 forty minute laboratory sessions. Two of these laboratories were based on projective transformations, two on euclidean transformations, and three on a transition from projective to euclidean.

4. It checked the grade differences on the attainment of the euclidean level by using grades 7, 8 and 9 students.
5. It checked Boe and Palow's findings on sex differences.

CHAPTER III

DESIGN AND PREPARATION OF TESTS AND LABORATORY EXPERIENCES

I. Introduction

The central purpose of this study was an attempt to see if students in the junior high schools were able to attain the euclidean level in the study of geometry. If they were not able to do this, would a concentrated and rich study in projective and euclidean transformations have assisted them in reaching that level. The previous chapter had given us the basis for the preparation of a testing instrument to determine whether students had reached the euclidean level. Piaget and Inhelder suggested that sectioning of solids would form the basis for the transition of students from projective to euclidean geometry because it involves both viewpoints and movements. They suggested two types of responses to make certain that the students' answers were a true indication of their representative space. This type of testing device was used by Boe (1966) in her research, Davis (1970) and Palow (1970) used the second type of response, multiple choice, for the sectioning of solids.

The laboratory experience needed as outlined in the problem was suggested by Piaget and Inhelder in the book "Child's Concept of Space." The authors have outlined the development of transformations from projective to euclidean level. This transition of a single viewpoint, multi-viewpoint, movement, the conservation of measurement of sides and angles, parallelism and the formation of coordinate axis

was used as the basis for the formation of laboratory experiences.

II. Design of the Testing Instrument

The testing instrument used in this study was the one used by Boe (1966) but with several modifications. First, this study needed a pretest and a postest of sufficient number of items. It was decided to use 16 items with the two type of responses for each. Therefore, a pilot study was done with 250 students in grades seven, eight and nine at Mount Carmel school. This pilot study determined the following:

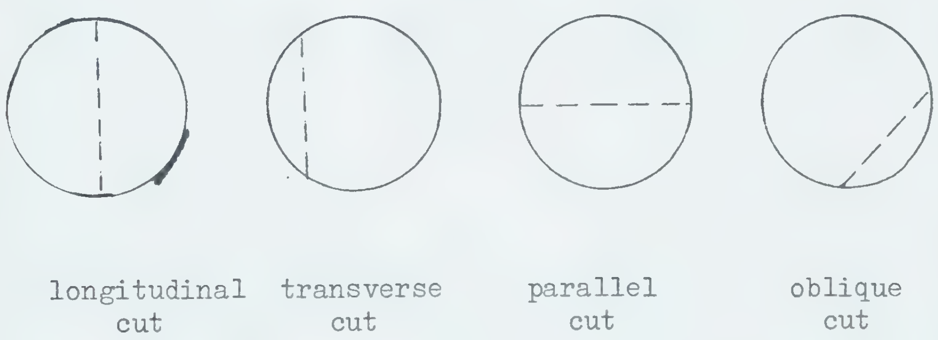
1. The four other solids consisting of triangular prism, parallelpiped, star and square pyramid to be added to the four used by Boe, namely the rectangular solid, cube, cylinder and cone.
2. It determined the solid to be used as a demonstration sample.
3. It determined the two comparative categories that these eight solids would be put into, to make up the pretest and postest of equal difficulty.
4. It determined the comparative difficulty of the four objects on the pretest and postest.
5. It determined the multiple-choice answers to be used on the four added solids and on the sample.

The following two groups were developed.

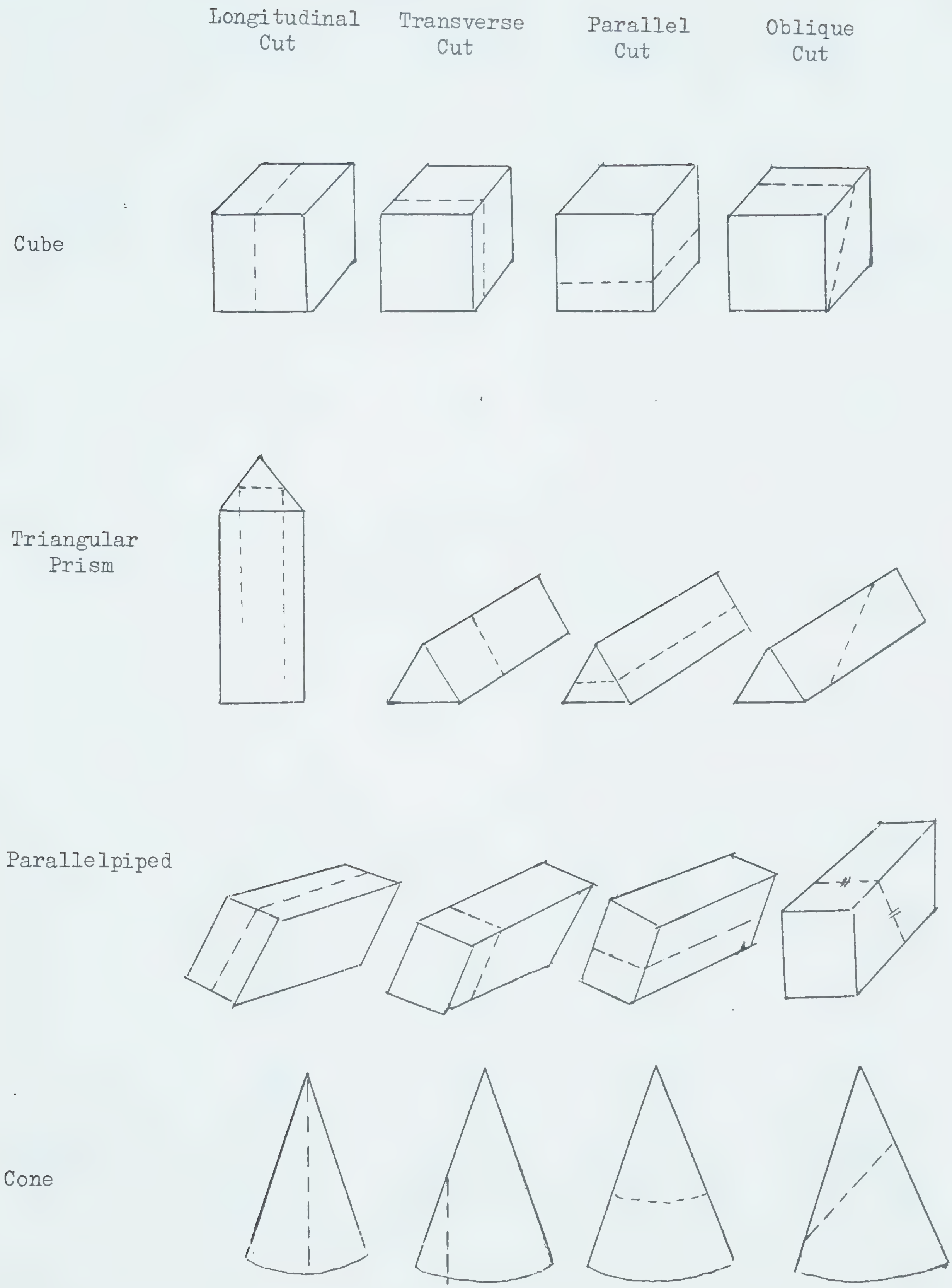
Pretest	Postest
1. cube	1. rectangular solid
2. triangular prism	2. cylinder
3. parallelpiped	3. star
4. cone	4. square pyramid

These groups yielded the following sample item and tests.

Sample: Sphere

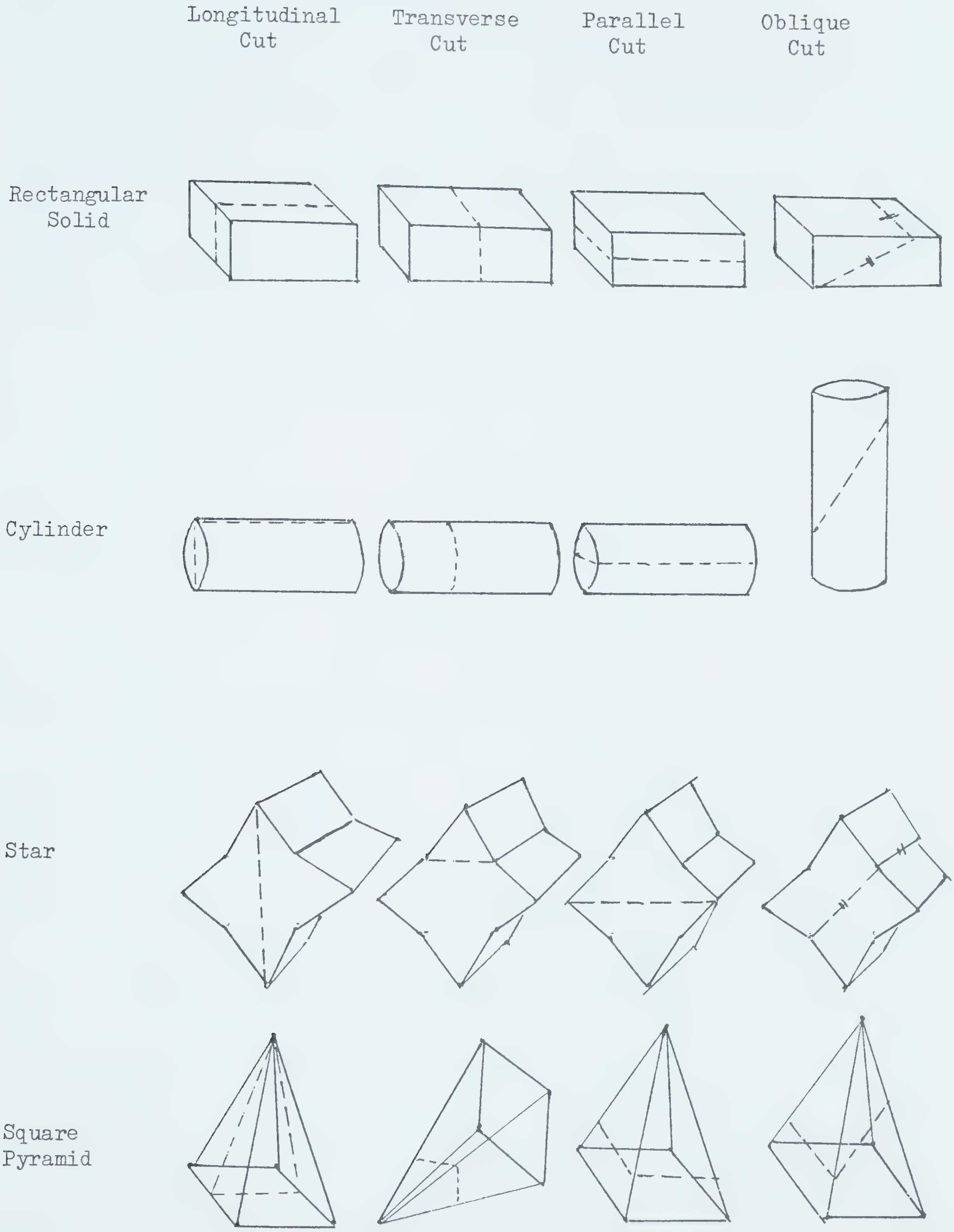


PRETEST



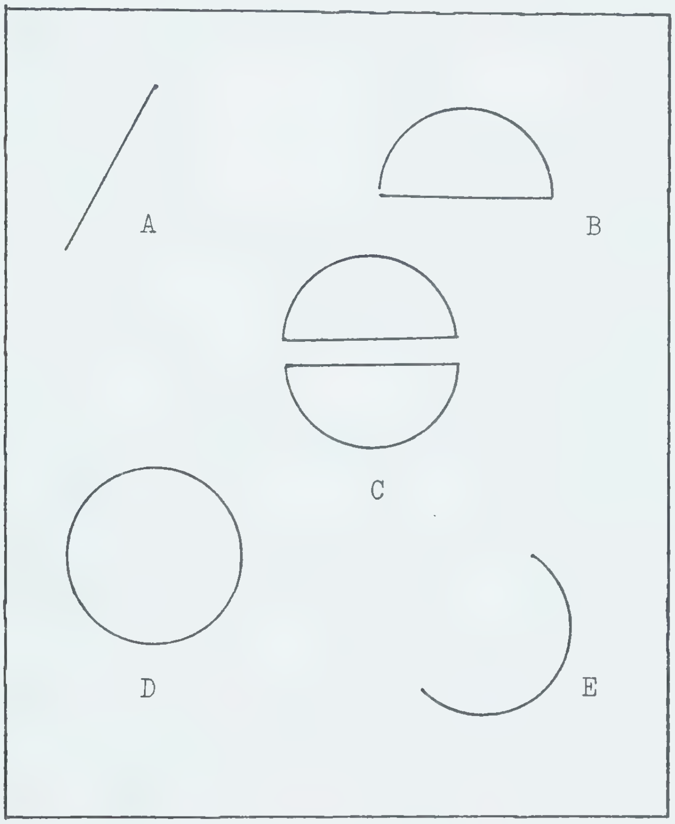
Longitudinal Cut
Transverse Cut
Parallel Cut
Oblique Cut
Cube
Triangular Prism
Parallelpiped
Cone

POSTEST


Longitudinal Cut
Transverse Cut
Parallel Cut
Oblique Cut
Rectangular Solid
Cylinder
Star
Square Pyramid

For the second type of response, five comparison drawings were developed using Piaget's suggestions in Piaget and Inhelder (1963, pp. 250-270), the drawings used by Boe (1966) and the selected drawings based on the pilot study. These multi-choice responses are given below.

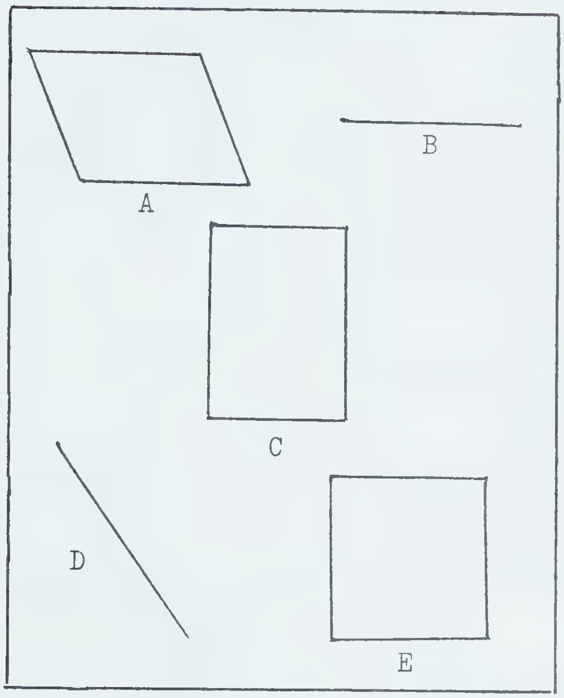
Sample: Sphere



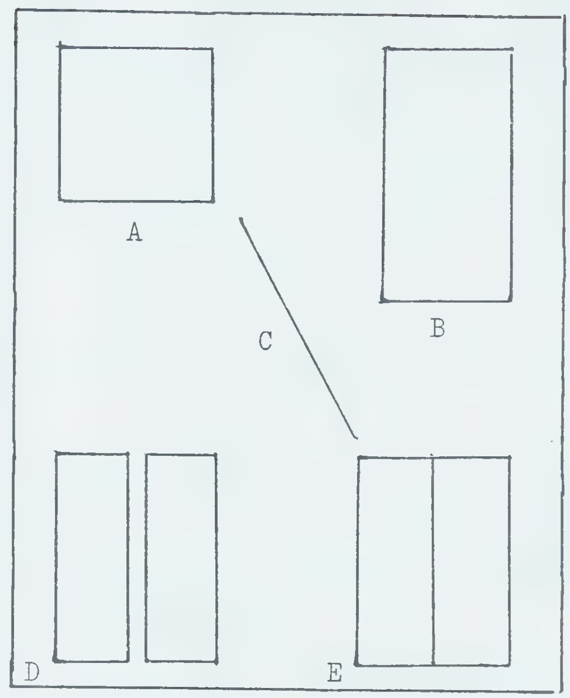
PRETEST

Cube

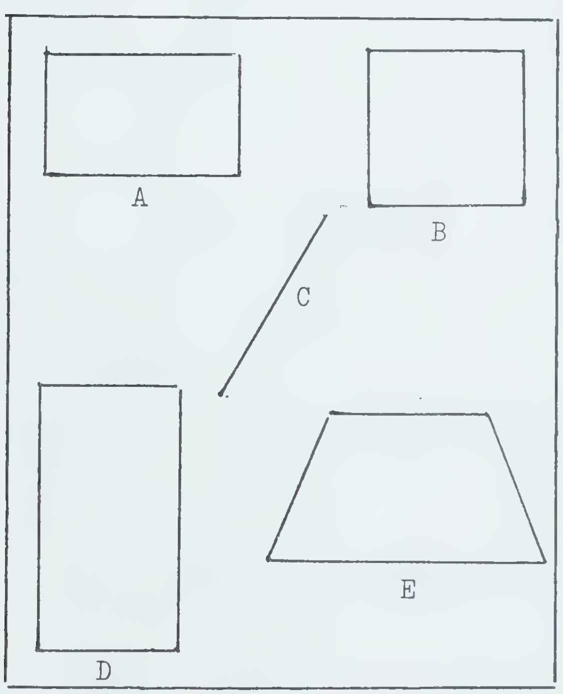
(1) Longitudinal Cut



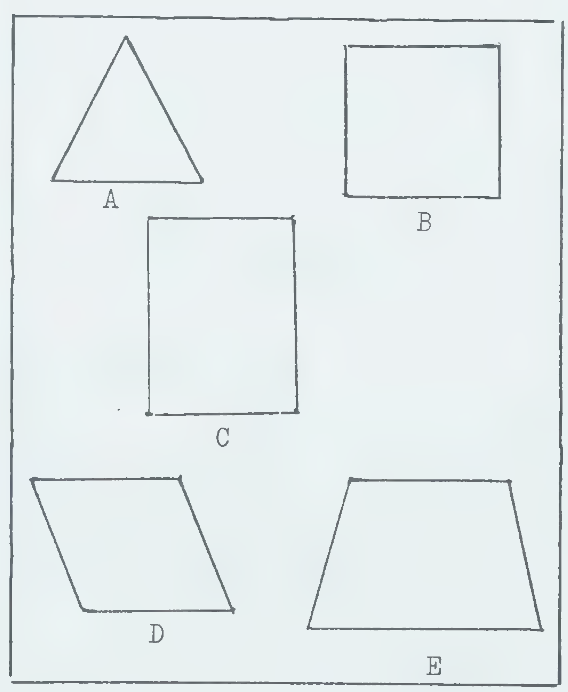
(2) Transverse Cut



(3) Parallel Cut

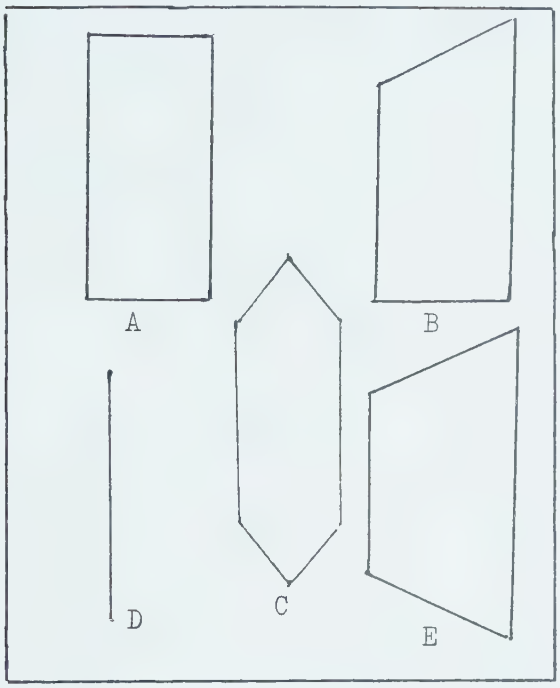


(4) Oblique Cut

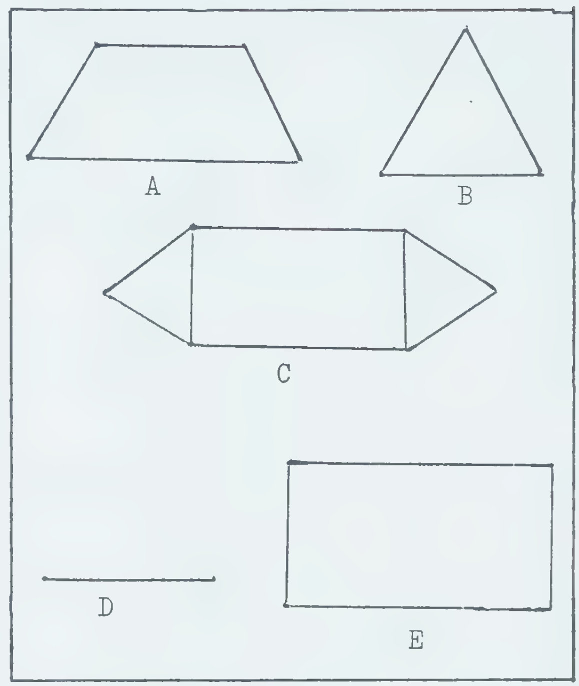


Triangular Prism

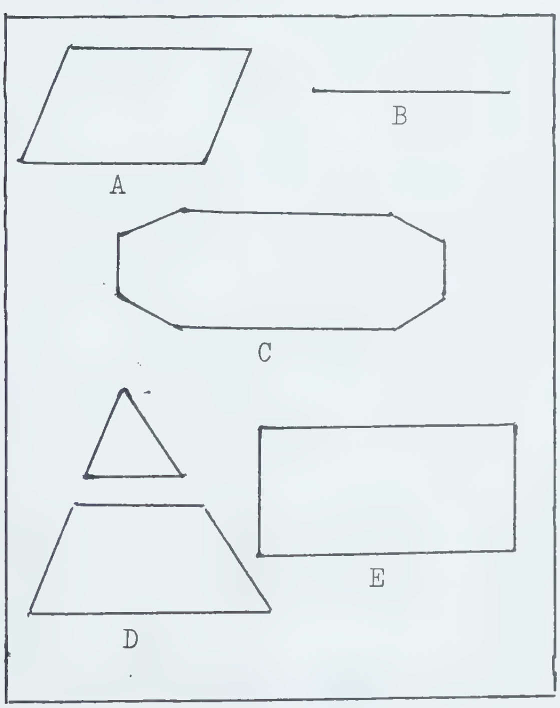
(1) Longitudinal Cut



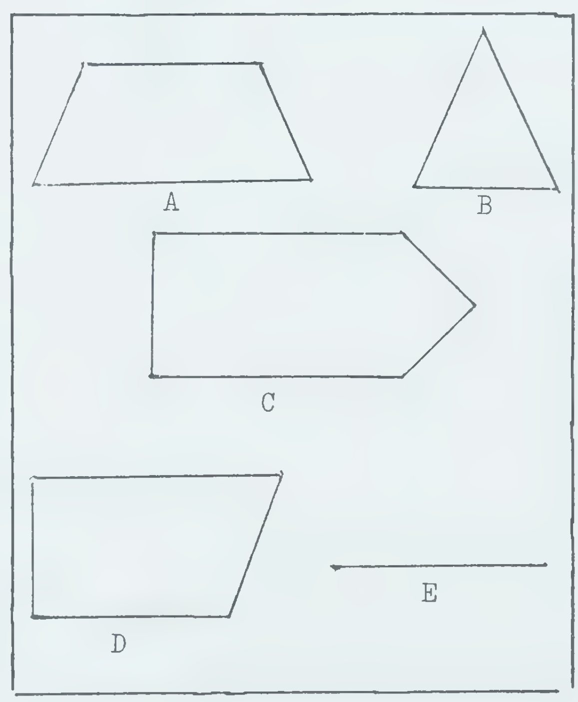
(2) Transverse Cut



(3) Parallel Cut

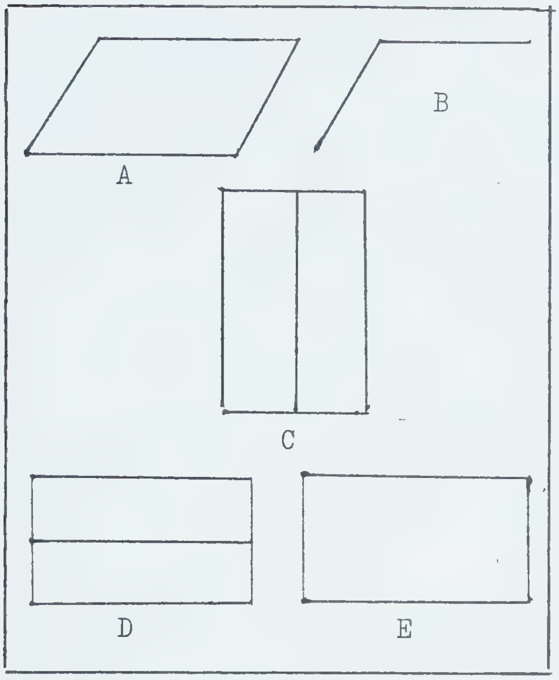


(4) Oblique Cut

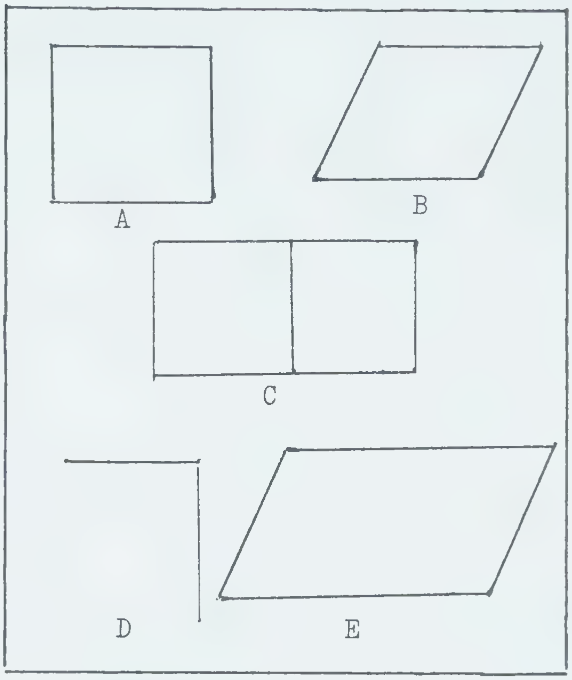


Parallelpiped

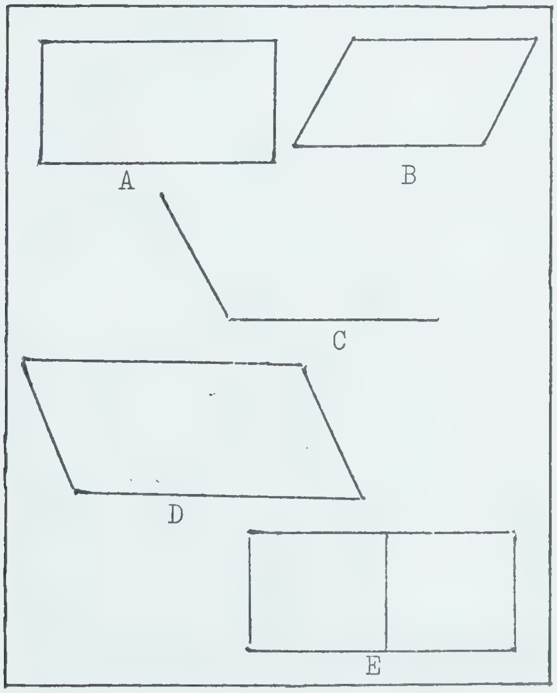
(1) Longitudinal Cut



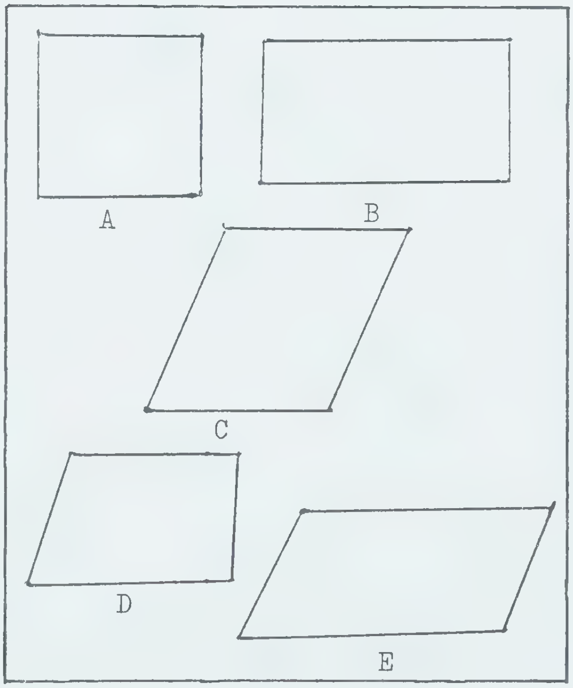
(2) Transverse Cut



(3) Parallel Cut

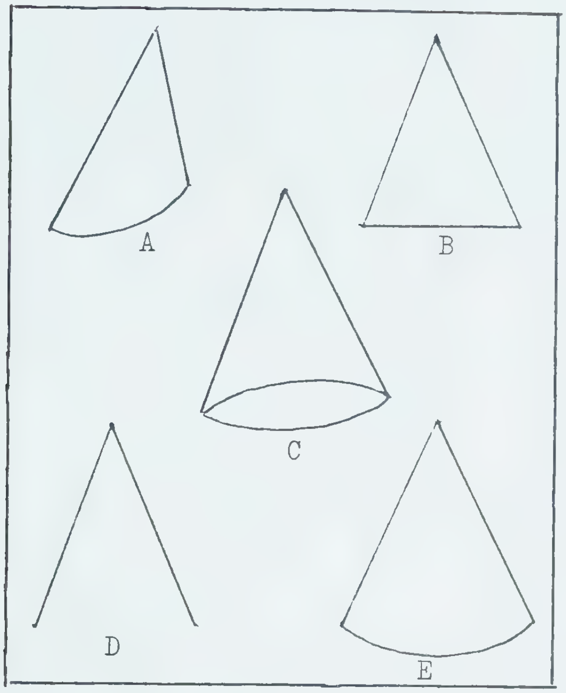


(4) Oblique Cut

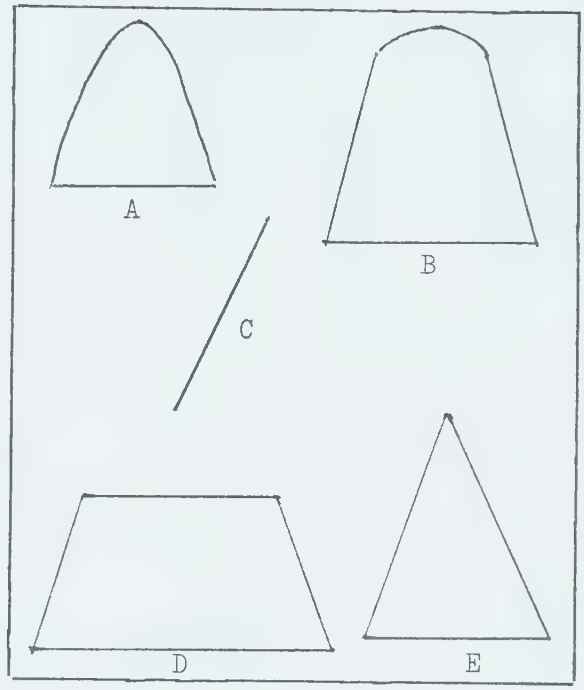


Cone

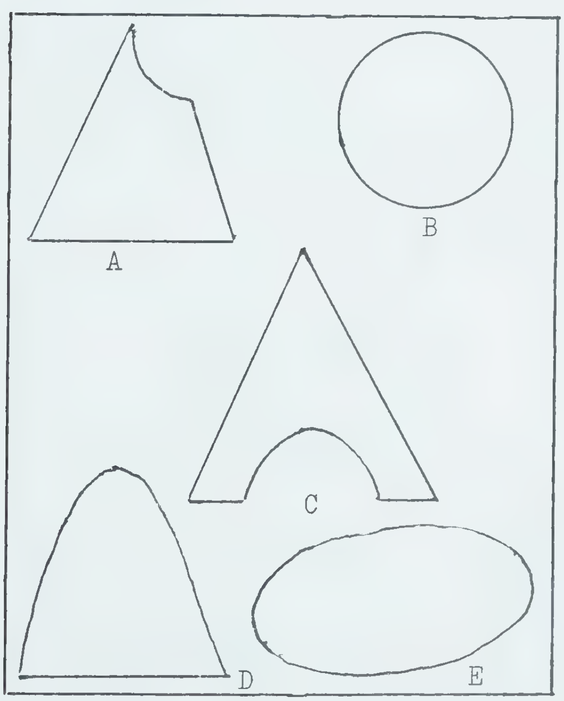
(1) Longitudinal Cut



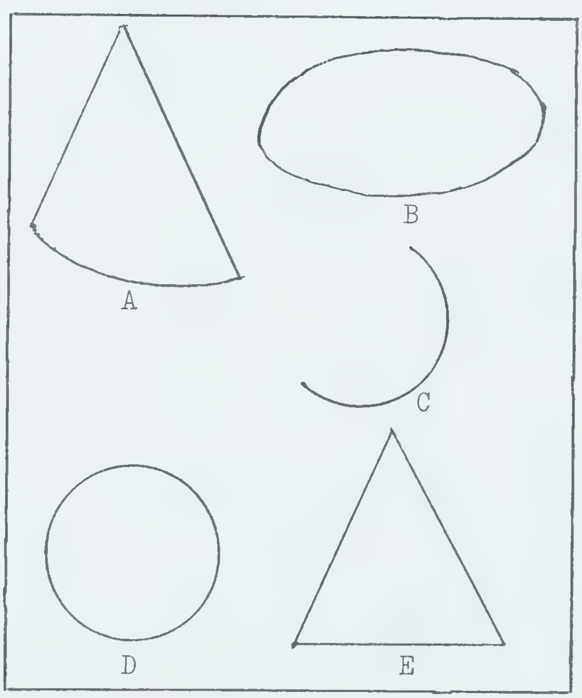
(2) Transverse Cut



(3) Parallel Cut



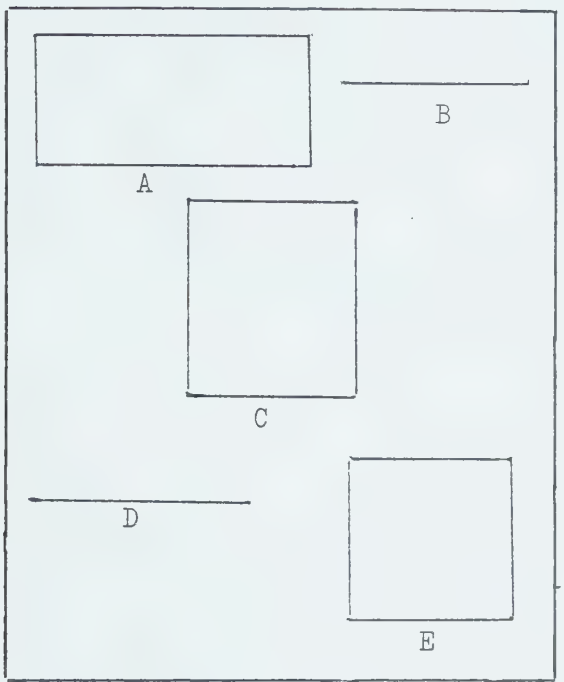
(4) Oblique Cut



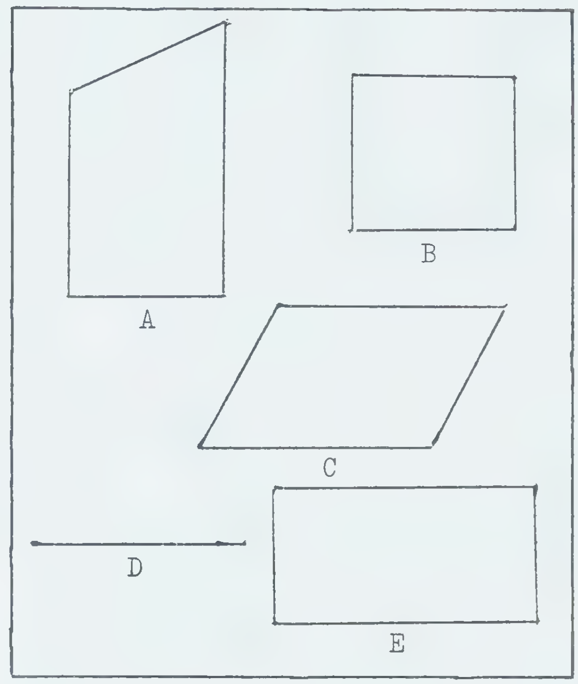
POSTEST

Rectangular Solid

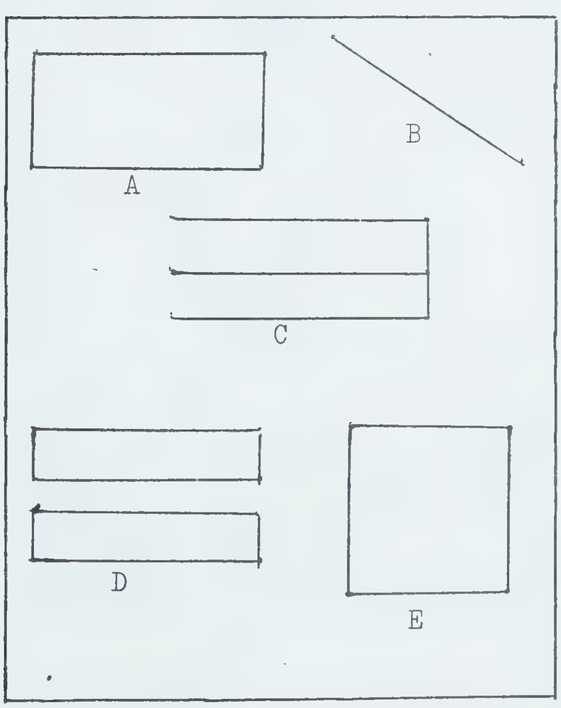
(1) Longitudinal Cut



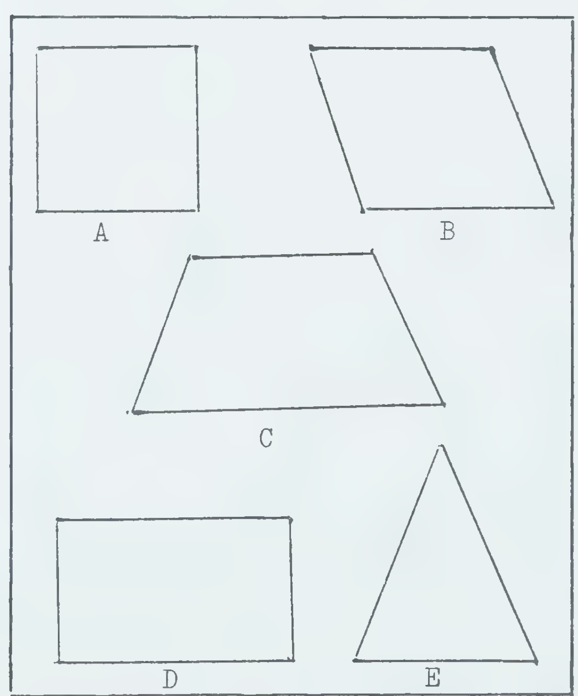
(2) Transverse Cut



(3) Parallel Cut

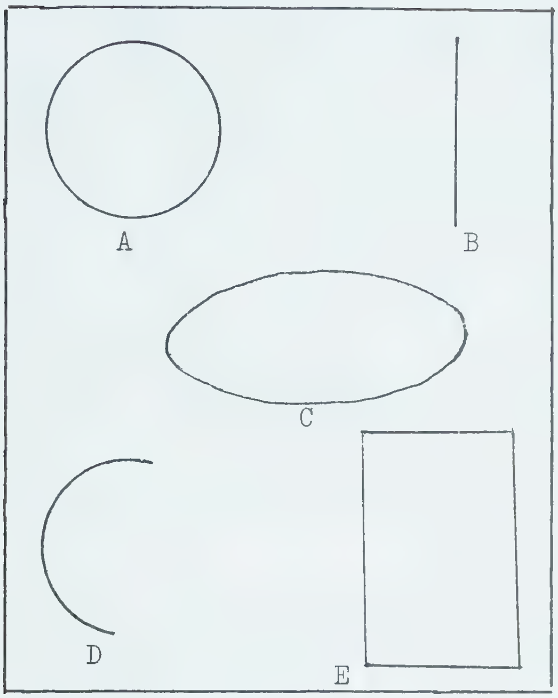


(4) Oblique Cut

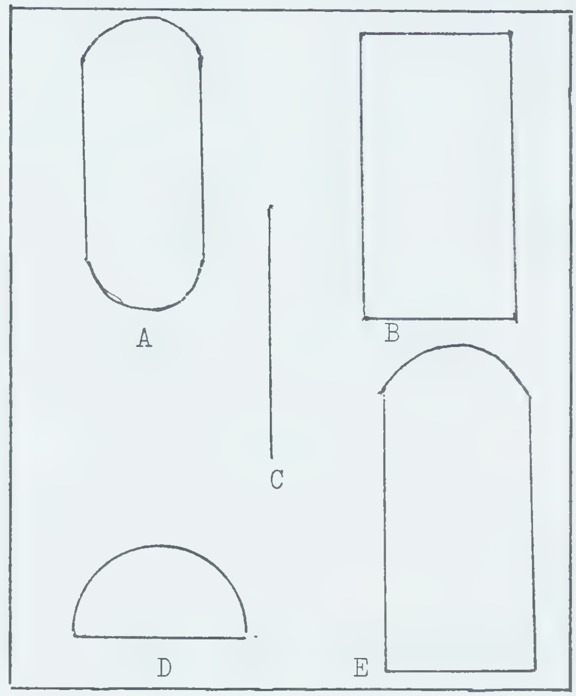


Cylinder

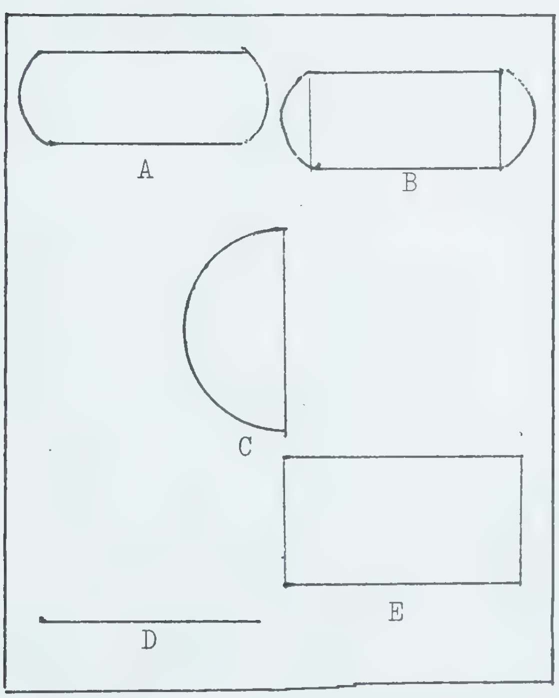
(1) Longitudinal Cut



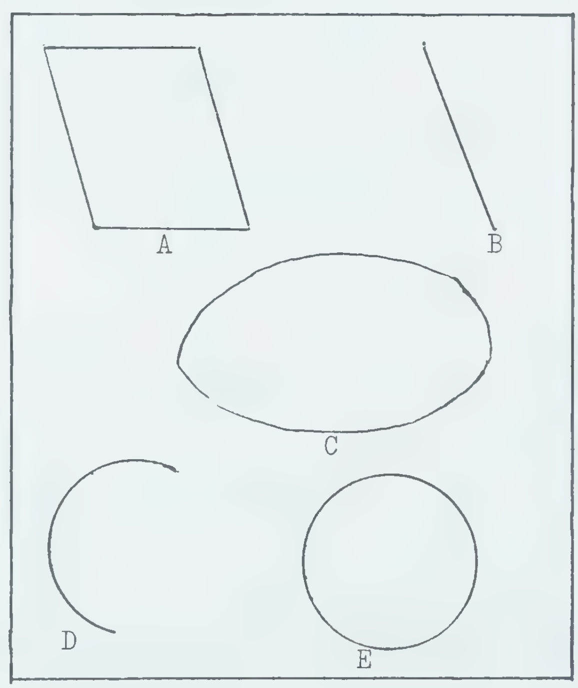
(2) Transverse Cut



(3) Parallel Cut

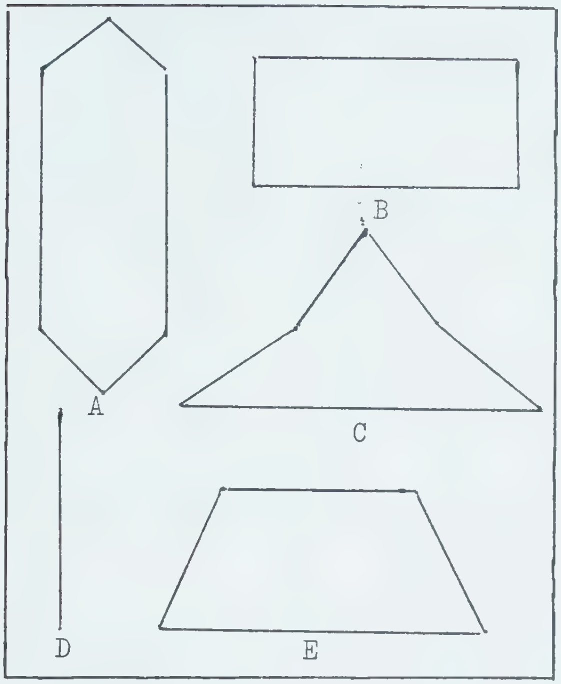


(4) Oblique Cut

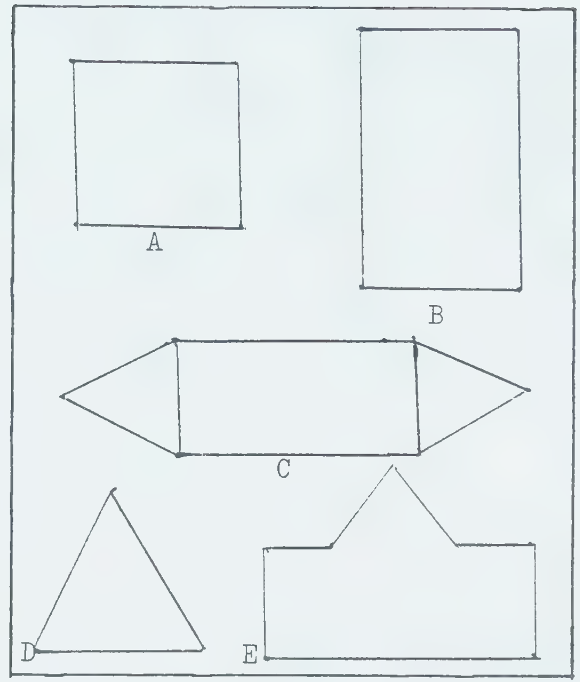


Star

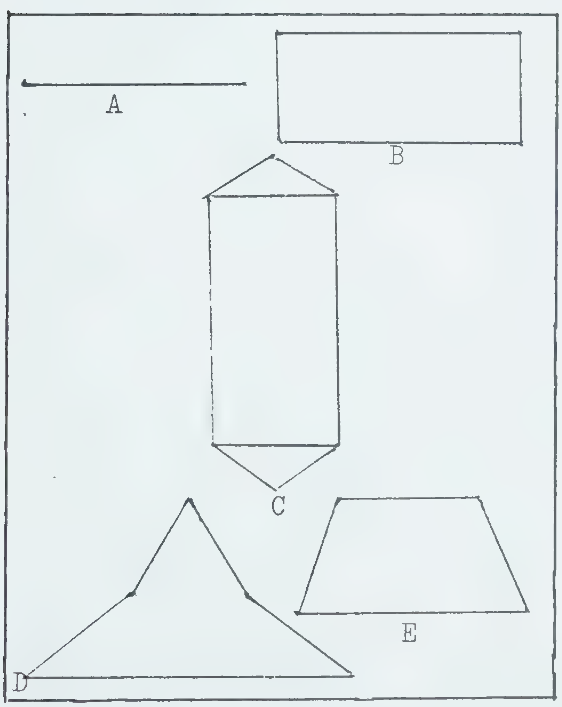
(1) Longitudinal Cut



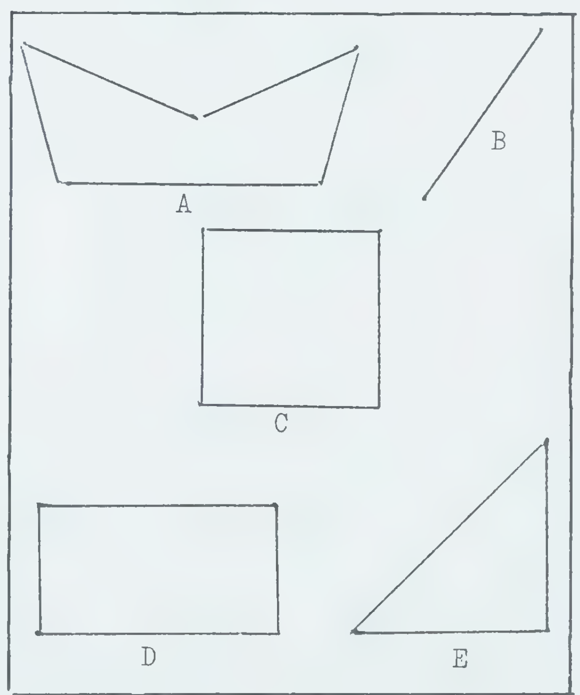
(2) Transverse Cut



(3) Parallel Cut

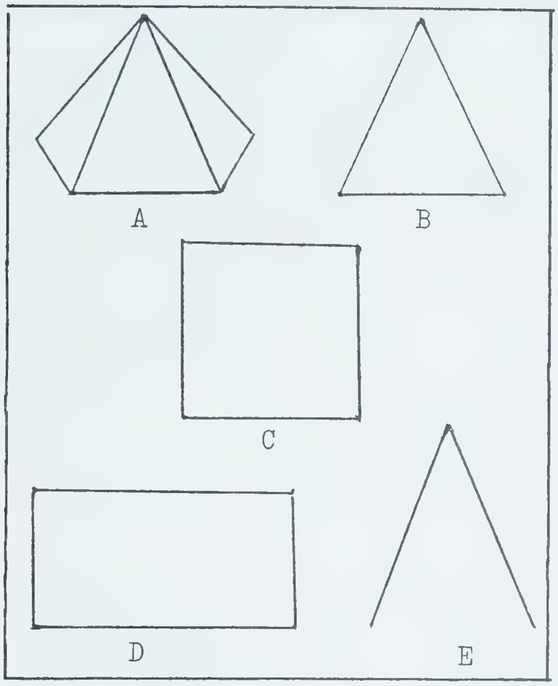


(4) Oblique Cut

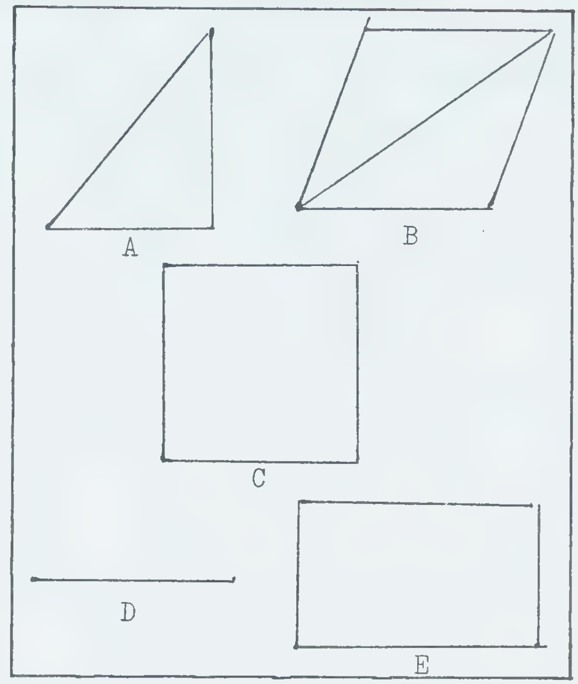


Square Pyramid

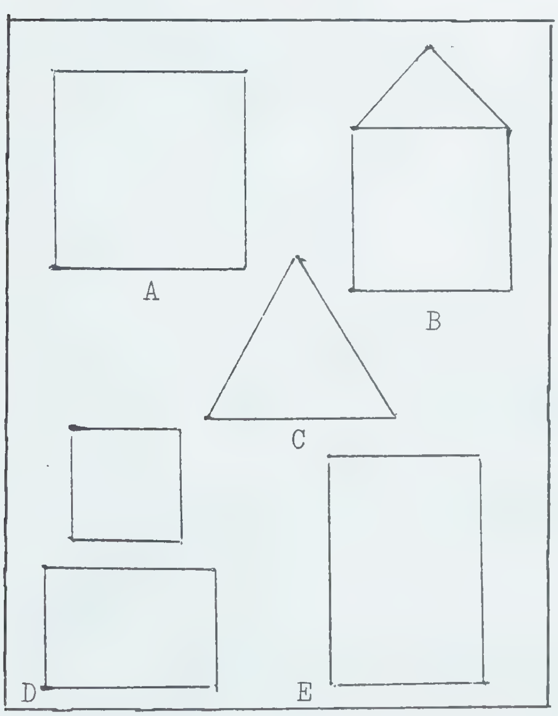
(1) Longitudinal Cut



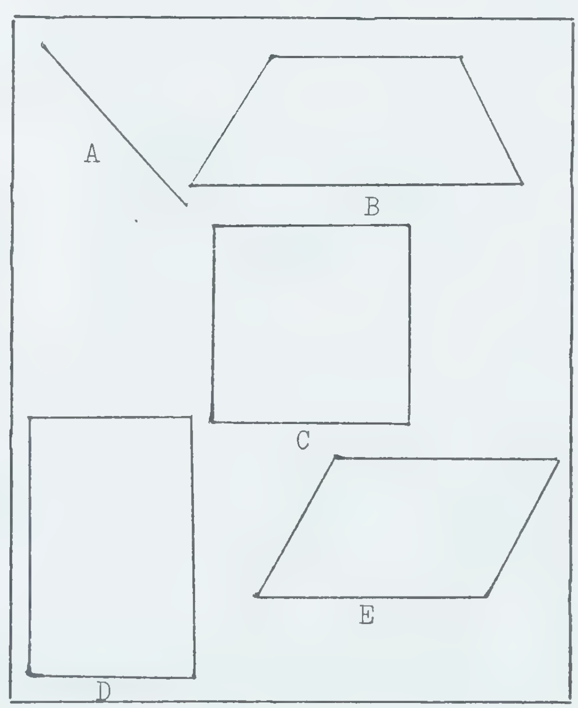
(2) Transverse Cut



(3) Parallel Cut



(4) Oblique Cut



III. Selection of Laboratory Activities

Activities were sought which would provide opportunities for students to develop the projective and euclidean transformations. This investigator selected materials suggested by Piaget and Inhelder (1963), by Vance (1969) and by Johnson (1957) and adapted them to grade seven, eight and nine level using suitable manipulative material. The following is a chart of the laboratory activities and the category they fall in. Following the chart, is a sample of activity on Shadows and Geometrical Sections. The complete set of activities is found in Appendix B.

Projective	Euclidean	Both
1. Shadows		
2. Coordination of Perspectives		
3.		Geometrical Sections
4.		Rotation and Development of Surfaces
5.		Polyhedra
6.	Similarities and Proportions	
7.	Paper Folding	

Shadows

Use the overhead projector and screen with the several items found in the box. You are to draw the shape you would expect the

shadow to assume. Then place the item on the overhead and check the shadow against your diagram.

		Expected Shadow	Actual Shadow on Screen
1.	Cone: Single Nappe		
	(a) upright		
	(b) inverted		
	(c) end-on		
2.	Two Nappe Cone		
	(a) upright		
	(b) horizontal		
3.	Cone with hole		
	(a) upright		

		Expected Shadow	Actual Shadow on Screen
3.	(b) inverted		
	(c) end-on		
4.	Cardboard Disc		
	(a) horizontal		
	(b) vertical		
5.	Rectangle		
	(a) horizontal		
	(b) vertical		
6.	Bobbin		
	(a) horizontal		

6. (b) vertical

7. Pencil

(a) horizontal

(b) vertical

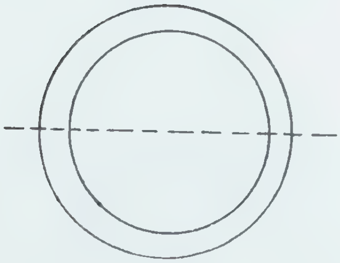
Geometrical Sections

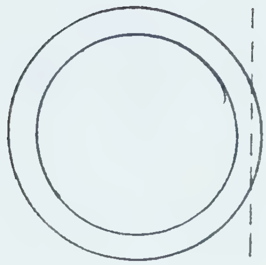
You are given six different plasticine figures. On each object you will perform certain cuts. Before you do the actual cutting, draw the shape of the plane surface you will expect to see when it is cut. Cut the object as shown by the diagram and compare your guess with the correct answer.

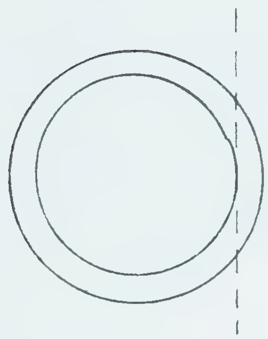
1. Closed circular annular ring

Surface you expect to see

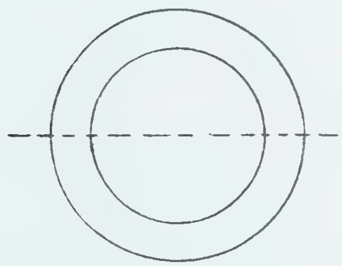
Actual surface as seen after the cut

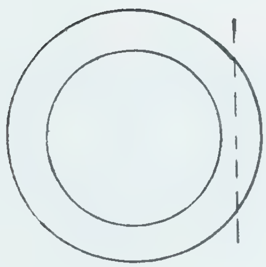


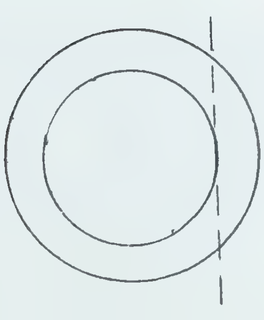




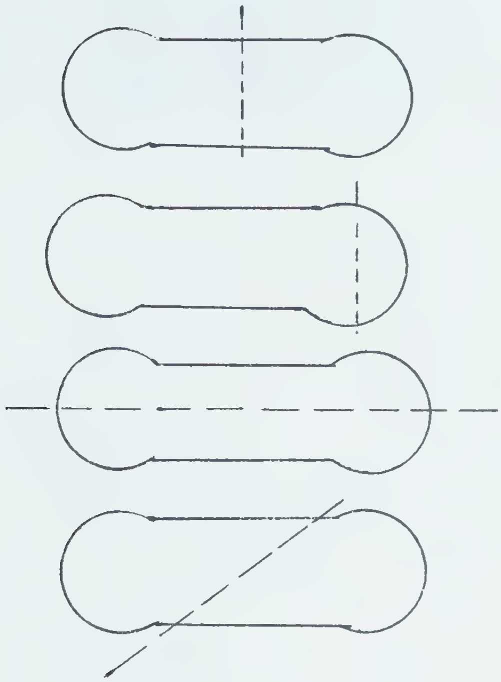
2. Closed square annular ring



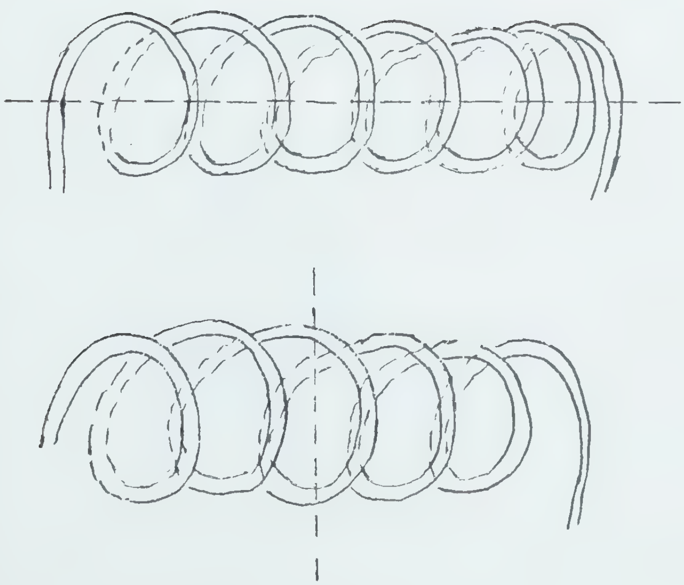


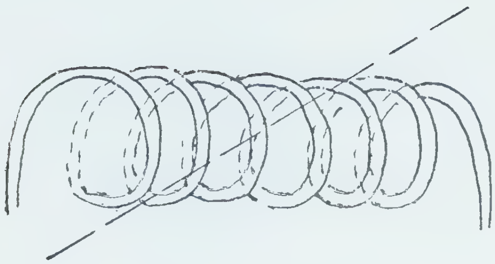


3. Dumbells (circular and square)

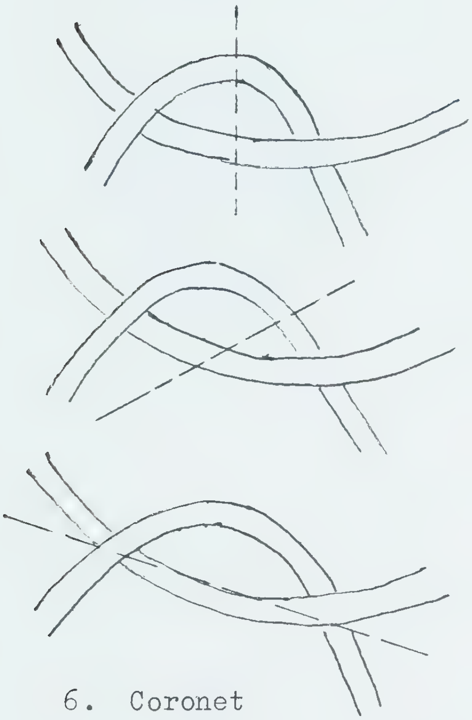


4. Helix

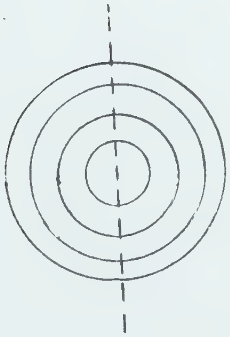


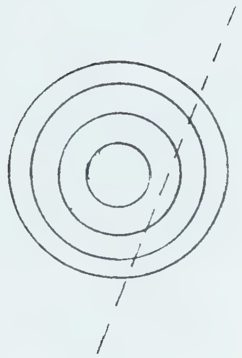


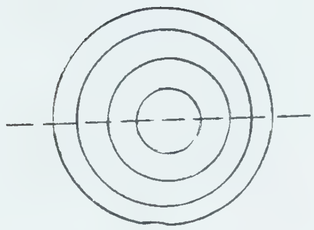
5. The Twist



6. Coronet







IV. Summary

The present chapter has been a description of the pretest and postest used in the study. It outlined the development of the second type of response used. These multiple choice type of answers were suggested by Piaget and Inhelder (1963), used by Boe (1966) and Davis (1970) on four solids and further developed for four other solids by the investigator following a pilot study done at Mount Carmel. In this chapter is enclosed the laboratory sequence and two samples of these laboratories.

The next chapter presents the design of the study and the gathering of data.

CHAPTER IV

DESIGN OF THE STUDY

I. Introduction

The previous chapter outlined the type of instruments used for the pretest and postest and the two types of responses used in each. It gave the laboratory experiences that were used by the students. Since it is clear that experience in one school differs from another, the experiment was conducted within two schools. This chapter will outline how the tests and laboratory experiences were carried out. It will describe the sample used, the random development of the questions on the tests, the procedure used in administration of the tests and the gathering of the data and the procedure used in the laboratory. This will be followed by an outline of the statistical analysis that will be used on the data.

II. The Sample

Four hundred twenty-two school pupils from two Edmonton Separate Schools formed the sample.

St. Brendan Junior High and St. Alphonsus Junior High were chosen on the basis that they were similar in size; similar because of heterogeneous grouping of classes; and both had self-contained classrooms.

The schools differed. St. Brendan had an enrollment of 216 students consisting of 3 grade seven, 3 grade eight and 2 grade nine classes and 3 mathematics teachers. It is located in the southeastern

section of the city of Edmonton in a relatively newly developed area. St. Alphonsus had an enrollment of 206 consisting of 3 grade seven (only 2 were used in the sample), 3 grade eight and 3 grade nine classes and 3 mathematics teachers. It is located in the central part of the city. Its population is a conglomerate of children whose parents are migrants within the city. Many Italian and Portuguese immigrants with little formal education live in this area.

Table I lists the number of children in each grade used in the study.

TABLE I

Schools from which the Sample was Selected

Schools	Grade 7	Grade 8	Grade 9
St. Alphonsus	52 (2 classes)	91 (3 classes)	63 (3 classes)
St. Brendan	84 (3 classes)	80 (3 classes)	52 (2 classes)

Since the students in the classes were heterogeneous, and for experimental purposes assumed randomly assigned, a random sample of a class at each grade level was selected to undergo the laboratory experience in each school.

These classes were selected.

St. Alphonsus	7C	26 students
	8B	31 students
	9B	24 students
	Total	81 students

St. Brendan	7C	26 students
	8A	29 students
	9A	31 students
	Total	86 students

III. Test Sequence

The two tests as outlined in Chapter III were used. These tests were made parallel in difficulty with a corresponding relative difficulty in the items of the test. The pilot study indicated that the cube and rectangular solid, triangular prism and cylinder, parallelpiped and star, and cone and square pyramid were of equal difficulty. It further showed that the cut on the cube was easiest and the cone most difficult to visualize. Each test consisted of two parts - section A and section B which differed only in the methods of response.

Both the order of the objects upon which the hypothetical cuts were made and the order of the type of cut on each object was selected randomly. See Appendix C for this order.

IV. Administration of the Tests

All students in the two schools were given the pretest and postest on a specific day. Eight forty minute periods on one specific day were used in St. Alphonsus and eight forty minute periods on the next day were used in St. Brendan. The same person, the author, administered all tests according to the predetermined order and directions.

Each child was given a score sheet made up of two parts - section A and section B. Section A had 16 spaces marked one through

sixteen; section B had six multiple answers labelled A, B, C, D, E, F per question. A large wooden solid figure and a knife were used as demonstrators for each cut. A sphere was used as a sample. This sphere was so constructed that when each of the four cuts were made, it could be taken apart to illustrate the plane figure formed by the cut.

Section A of the test was given first. The subject responded by making a drawing of the boundary formed by the hypothetical cut. The responses for section B were selected from pre-drawn boundaries placed on overhead transparencies. As the cut was demonstrated, the particular transparency was placed and made visible on the screen. The student circled his choice of A, B, C, D, E, or F, where F represented "none of these."

Both sections were administered to the entire class in a forty minute period.

V. Data

The data for each subject was recorded on response sheets. The first page required the student to give name, school, grade, sex and age in years and months. The second and third page consisted of sixteen spaces where the drawings were made. The last page contained the sixteen multiple choice response set. An appropriate response in section A implied that the figure was clearly recognizable as the appropriate figure. In the scoring of both sections A and B, a "1" indicated a correct response while "0" indicated an incorrect one. A total score of 32 was possible.

VI. Administration of the Laboratory

Eight stations of the identical laboratory, given in the order of the theoretical development, were set up on the science room of the two schools so that all students worked on the same laboratory exercise on the particular day. The students were divided in groups of 3 or 4. Each student had his own instruction sheet and worked individually within the group or as a group unit. Each student was responsible for his own discovery. Each laboratory exercise took 25 to 30 minutes. The whole class met to discuss the findings for 15 minutes per day.

VII. Treatment of Data

The prime consideration was to test the two major hypotheses and the three minor hypotheses. Major hypothesis 1 was tested by using an anlysis of variance about a population mean. (McNemar, 1969, p. 85). A population mean of 32.00 (Piaget and Inhelder, 1963) and 24.00 (Davis, 1970) was selected. Major hypothesis 2 was tested by an analysis of variance using an interaction of treatment and grade levels.

Minor hypotheses 3 and 5 were tested using an analysis of variance. Hypothesis 4 was tested by using the grade levels treatment of hypothesis 2.

VIII. Summary

The present chapter had been a description of the sample used, the test sequence and the procedure used in carrying out the test

and laboratory activities, the scoring of the answer sheets and the method used for the analysis of the data. The next chapter presents the results of the analysis of the data.

CHAPTER V

ANALYSIS OF THE DATA

This chapter presents the experimental results. The following system of reporting the results is employed. First, a statement of the null hypothesis to be tested is presented, followed by a table of the summary of the analysis of variance. Conclusions are then stated concerning the rejection or non-rejection of the hypothesis.

Hypothesis 1

The students of the two junior high schools have reached the euclidean level of maturity in geometry based on the pretest.

This hypothesis will be tested about a population mean. (McNemar, 1969, p. 85) Piaget stated that students at the age of 13 or 14 will have attained the euclidean level of maturity. It is therefore assumed that if that level is reached, the score for each student would be 32. Therefore the population mean would be 32.

TABLE II

Determination of z-score about a Mean Population of 32

	Defined Mean	Mean of Population	Number	Standard Deviation	Standard Error	z-score
School 1	32.00	15.50	216	6.05	.41	40.08
School 2	32.00	13.50	206	6.27	.44	42.34
Total Population	32.00	14.52	422	6.24	.30	57.53

The probability for as large a deviation from 32.00 for z = 40.08, 42.34, 57.53 is .000000 (McNemar, Table A). Since this probability is smaller than P = .01, we reject the hypothesis.

Davis (1970) stated that a reasonable level of achievement for attainment of the euclidean level would be a mean score of 24. Using this as the defined mean the table would be:

TABLE III

Determination of z-score about a Mean Population of 24

	Defined Mean	Mean of Population	Number	Standard Deviation	Standard Error	z-score
School 1	24.00	15.50	216	6.05	.41	20.65
School 2	24.00	13.50	206	6.27	.44	21.74
Total Population	24.00	14.52	422	6.24	.30	31.20

The probability for as large a deviation from 24.00 for z = 20.65, 21.74, and 31.20 is .000000 (McNemar, Table A). Since this probability is smaller than P = .01, we reject the hypothesis about this mean of 24.00. That is, students have not reached the level such that the sample mean is 24.

Hypothesis 2:

There is no significant difference between the mean scores obtained by students who have had laboratory experience and

those who have not as determined by a postest.

TABLE IV

Cell Means for School 1

	7	8	9
No Lab	15.24	11.90	19.91
Lab	19.04	22.00	26.58

TABLE V

Summary of the Interaction of Treatment and Grade Levels - School 1

Source of Variance	SS	df	MS	F	P
A. No Lab vs Lab	2161	1	2161	53.56*	.01
B. Grades	1571	2	785.75	19.47	
AB	9.94	2	4.97	0.12	
Within Cell	8271	205	40.35		

The calculated F-ratio* exceeds the tabled F-ratio of 6.64 for A. The hypothesis is rejected for school 1.

TABLE VI

Cell Means for School 2

	7	8	9
No Lab	15.92	11.12	20.48
Lab	21.72	20.22	27.48

TABLE VII

Summary of the Interaction of Treatment and Grade Levels - Schools 2

Source of Variance	SS	df	MS	F	P
A. No Lab vs Lab	2392	1	2392	63.4*	.01
B. Grades	2123	2	1062	28.2	
AB	30	2	15	.4	
Within Cell	7510	199	37.74		

The calculated F-ratio* exceeds the tabled F-ratio of 6.64 for A. The hypothesis is rejected for school 2.

(See appendix D for analysis for total population)

Hypothesis 3:

There is no significant difference in the scores of students in the two junior high schools based on the pretest and postest.

TABLE VIII

Summary of Analysis of Variance - Pretest

	SS	df	MS	F-Ratio
Between Schools	421.76	1	421.76	11.06
Experimental Error	16011.50	420	38.12	

$F_{.99}\ (1,420) = 6.73$

$F_{obs} > F_{.99}$

Therefore the hypothesis is rejected for the pretest.

TABLE IX

Summary of Analysis of Variance - Postest
(including laboratory experience)

	SS	df	MS	F-Ratio
Between Schools	3.86	1	3.86	.06
Experimental Error	26622.10	414	64.30	

$F_{.99}\ (1,414) = 6.73$

$F_{obs} < F_{.99}$

The hypothesis is therefore not rejected.

TABLE X

Summary of Analysis of Variance - Postest
(Laboratory Experience Only)

	SS	df	MS	F-Ratio
Between Schools	.04	1	.04	.00
Experimental Error	5404.18	154	35.09	

$F_{.99}\ (1,154) = 6.82$

$F_{obs} < F_{.99}$

The hypothesis is not rejected.

Subsidiary Hypothesis:

There is no significant difference between the scores on the pretest and the scores on the postest (no laboratory experience).

TABLE XI

Mean Scores for School 1

Grade	Pretest	Postest (No lab)
7	13.76	15.24
8	14.74	11.90
9	19.48	23.83

TABLE XII

Mean Scores for School 2

Grade	Pretest	Postest (No lab)
7	13.00	15.92
8	11.16	11.12
9	17.29	20.48

TABLE XIII

Summary of Analysis of Variance

	SS	df	MS	F-Ratio
Between Pretest and Postest (no lab)	45.88	1	45.88	.99
Experimental Error	31613	680	46.49	

$F_{.99}\ (1,680) = 6.64$

$F_{obs} < F_{.99}$

This hypothesis is not rejected.

Hypothesis 4:

There is no significant difference in the scores at an increasing grade level as determined by the pretest and postest.

TABLE XIV

Mean Scores for School 1

Grade	Pretest	Postest (Lab. included)	Postest (Lab)
7	13.76	16.29	19.04
8	14.74	15.53	22.00
9	19.48	23.83	26.58

TABLE XV

Summary of Analysis of Variance for Pretest

	SS	df	MS	F-Ratio
Between Classes	1124.29	2	562.15	17.65
Experimental Error	6783.71	213	31.85	

$F_{.99}\ (2,213) = 4.70$

$F_{obs} > F_{.99}$

TABLE XVI

Mean Scores for School 2

Grade	Pretest	Postest (Lab. included)	Postest (Lab)
7	13.00	18.88	21.72
8	11.16	13.94	20.22
9	17.29	22.81	27.48

TABLE XVII

Summary of Analysis of Variance for Pretest

	SS	df	MS	F-Ratio
Between Classes	1412.12	2	706.06	21.42
Experimental Error	6691.38	203	32.96	

$F_{.99}\ (2,203) = 4.71$

$F_{obs} > F_{.99}$

The hypothesis in the above two cases has been rejected.

The hypothesis was tested on the postest which included the sample population with laboratory experience.

TABLE XVIII

Summary of Analysis of Variance for School 1 - Postest

	SS	df	MS	F-Ratio
Between Classes	2499.27	2	1249.63	23.98
Experimental Error	10841.20	208	52.12	

$F_{.99}\ (2,208) = 4.71$

$F_{obs} > F_{.99}$

TABLE XIX

Summary of Analysis of Variance for School 2 - Postest

	SS	df	MS	F-Ratio
Between Classes	3065.11	2	1532.56	30.30
Experimental Error	10216.53	202	50.58	

$F_{.99}$ $(2,202) = 4.71$

$F_{obs} > F_{.99}$

The hypothesis was rejected.

The hypothesis was tested on the mean scores from the postest for the sample with laboratory experience only.

TABLE XX

Summary of Analysis of Variance for
School 1 - Postest (Lab)

	SS	df	MS	F-Ratio
Between Classes	783.89	2	391.95	16.10
Experimental Error	1898.50	78	24.34	

$F_{.99}$ $(2,78) = 4.93$

$F_{obs} > F_{.99}$

TABLE XXI

Summary of Analysis of Variance for
School 2 - Postest (Lab)

	SS	df	MS	F-Ratio
Between Classes	710.34	2	355.17	12.71
Experimental Error	2011.45	72	27.94	

$F_{.99}\ (2,72) = 4.94$

$F_{obs} > F_{.99}$

The hypothesis was rejected.

Tests were conducted to show where these differences occurred.

TABLE XXII

Grade Level Hypothesis
F-Ratio

	7 - 8	8 - 9	7 - 9
School 1			
Pretest	1.13*	22.6	32.4
Postest	.39*	41.6	41.8
Postest (Lab)	3.49*	17.2	32.4
School 2			
	7 - 8	8 - 9	7 - 9
Pretest	5.16*	39.1	13.5
Postest	13.9	57.2	10.6
Postest (Lab)	.89*	23.3	20.0

The differences occurred between grades 8 - 9 and 7 - 9 but not 7 - 8* except school 2, postest.

Hypothesis 5:

There is no significant difference in the scores between boys and girls based on:

(a) pretest

(b) postest

(c) postest on laboratory group.

TABLE XXIII

Summary of Analysis of Variance for
School 1 - Pretest

	SS	df	MS	F-Ratio
Between Sexes	13.01	1	13.01	.35
Experimental Error	7894.99	214	36.89	

$F_{.99}\ (1,214) = 6.75$

TABLE XXIV

Summary of Analysis of Variance for
School 2 - Pretest

	SS	df	MS	F-Ratio
Between Sexes	.24	1	.24	.01
Experimental Error	8103.26	204	39.72	

$F_{.99}\ (1,204) = 6.76$

The hypothesis is not rejected for both schools on the basis of the pretest.

TABLE XXV

Summary of Analysis of Variance for School 1 - Postest

	SS	df	MS	F-Ratio
Between Sexes	44.27	1	44.27	.70
Experimental Error	13296.19	209	63.62	

$F_{.99}$ (1,209) = 6.76

TABLE XXVI

Summary of Analysis of Variance for School 2 - Postest

	SS	df	MS	F-Ratio
Between Sexes	1.06	1	1.06	.02
Experimental Error	13280.58	203	65.42	

$F_{.99}$ (1,203) = 6.76

On the basis of the postest, the hypothesis is not rejected for both schools.

TABLE XXVII

Summary of Analysis of Variance for
School 1 - Postest (Lab Experience)

	SS	df	MS	F-Ratio
Between Sexes	7.21	1	7.21	.21
Experimental Error	2675.18	79	33.86	

$F_{.99}\,(1,79) = 7.01$

TABLE XXVIII

Summary of Analysis of Variance for
School 2 - Postest (Lab Experience)

	SS	df	MS	F-Ratio
Between Sexes	.05	1	.05	.00
Experimental Error	2721.74	73	37.28	

$F_{.99}\,(1,73) = 7.01$

On the basis of the postest (lab experience), the hypothesis is not rejected for both schools.

TABLE XXIX

Summary

1. Euclidean Level Hypothesis	A. At the 32 mean score level	School 1	rejected
		School 2	rejected
	B. At the 24 mean score level	School 1	rejected
		School 2	rejected
2. Laboratory Hypothesis		School 1	rejected
		School 2	rejected
3. School Hypothesis	Pretest		rejected
	Postest		not rejected
	Postest (no lab)		not rejected
	Postest (lab)		not rejected
4. Grade Hypotheses	The difference occurred between grades 8 - 9 and 7 - 9 but not 7 - 8, except school 2, postest		rejected
5. Sex Hypotheses	Pretest	School 1	not rejected
		School 2	not rejected
	Postest	School 1	not rejected
		School 2	not rejected
	Postest (lab only)	School 1	not rejected
		School 2	not rejected

CHAPTER VI

INTERPRETATIONS, CONCLUSIONS, AND RECOMMENDATIONS

I. General Overview of the Study

Purpose:

A basic question that arises in education is the role played by maturity and experience in determining the prerequisites for learning. This general relationship of maturity and experience was studied in the specific area of euclidean geometry. Three basic questions were asked:

1. Have junior high students reached the euclidean level of geometric maturity as measured by a specific test of this capability?
2. Can instructional procedure be constructed which provide primitive experience with projective and euclidean geometric concepts?
3. If students are not geometrically mature, do instructional procedures, special mathematics laboratories contribute to growth in measured maturity?

In response to these questions, this study centered on the development of a pretest and postest to measure this geometric maturity; the development of a series of very rich experiences in projective and euclidean geometry and to place these experiences in a laboratory setting for students to be able to actively engage in the use of concrete materials and tasks on an individual or small group bases and become active learners.

Design:

The study involved four hundred twenty-two grade 7, 8 and 9 students from two schools. The pretest and postest was administered to all in sixteen forty minute periods, using large wooden objects. Two types of responses were used. Since the sixteen classes involved were heterogeneous, a random sample of a class per grade in each school was selected. This involved 167 students. Eight stations of each of the seven laboratories were set up in the science room of the schools twice per week. The students were divided into groups of 3 or 4. Each student, however, was responsible for his own discovery. Finally the whole class met to discuss the findings.

II. Significant Results

Hypotheses Reviewed:

The hypotheses basic to the study are relisted below, the first two constituting the major thrust of this investigation.

1. The students of the two junior high schools have reached the euclidean level of maturity in geometry based on the pretest.
2. There is no significant difference in the scores attained by students who have had laboratory experience and those who have not as determined by a postest.
3. There is no significant difference in the scores of students in the two junior high schools based on the pretest and postest.
4. There is no significant difference in the scores at an increasing grade level as determined by the pretest and postest.
5. There is no significant difference in the scores between boys and girls based on:

(a) pretest

(b) postest on control group

(c) postest on laboratory group.

III. Summary of Results

The analysis of the data produced by the investigation revealed the following statistically significant interactions and differences between accepted means and treatments taken at the .01 level of acceptance.

1. The students of the two junior high schools had not reached the euclidean level of maturity at the accepted mean of 32 or at the accepted mean of 24.
2. There was a significant difference in the scores attained by students who had laboratory experience and those who did not.
3. There was a significant difference in the scores of students between the schools based on the pretest. However there was no significant difference on the postest including all students; no significant difference for those with no laboratory experience and those with laboratory experience only.
4. There was a significant difference in the scores between the grades 7 - 9 and 8 - 9 at both schools on the pretest, postest and postest (laboratory only).
5. There was no significant difference between the sexes on the pretest, postest and postest (laboratory only).

IV. Discussion

If we consider these results and the literature, our findings

concur with Boe and Davis. They clearly emphasize the importance of experience. The interaction between experience and maturity can be indicated by Figure 1 in which

(1) represents the maturity growth based on Piaget's geometric levels. (Piaget and Inhelder, 1963)

(2) represents the averages of students on the postest without labs.

(3) represents the averages of students on the postest with laboratory experience.

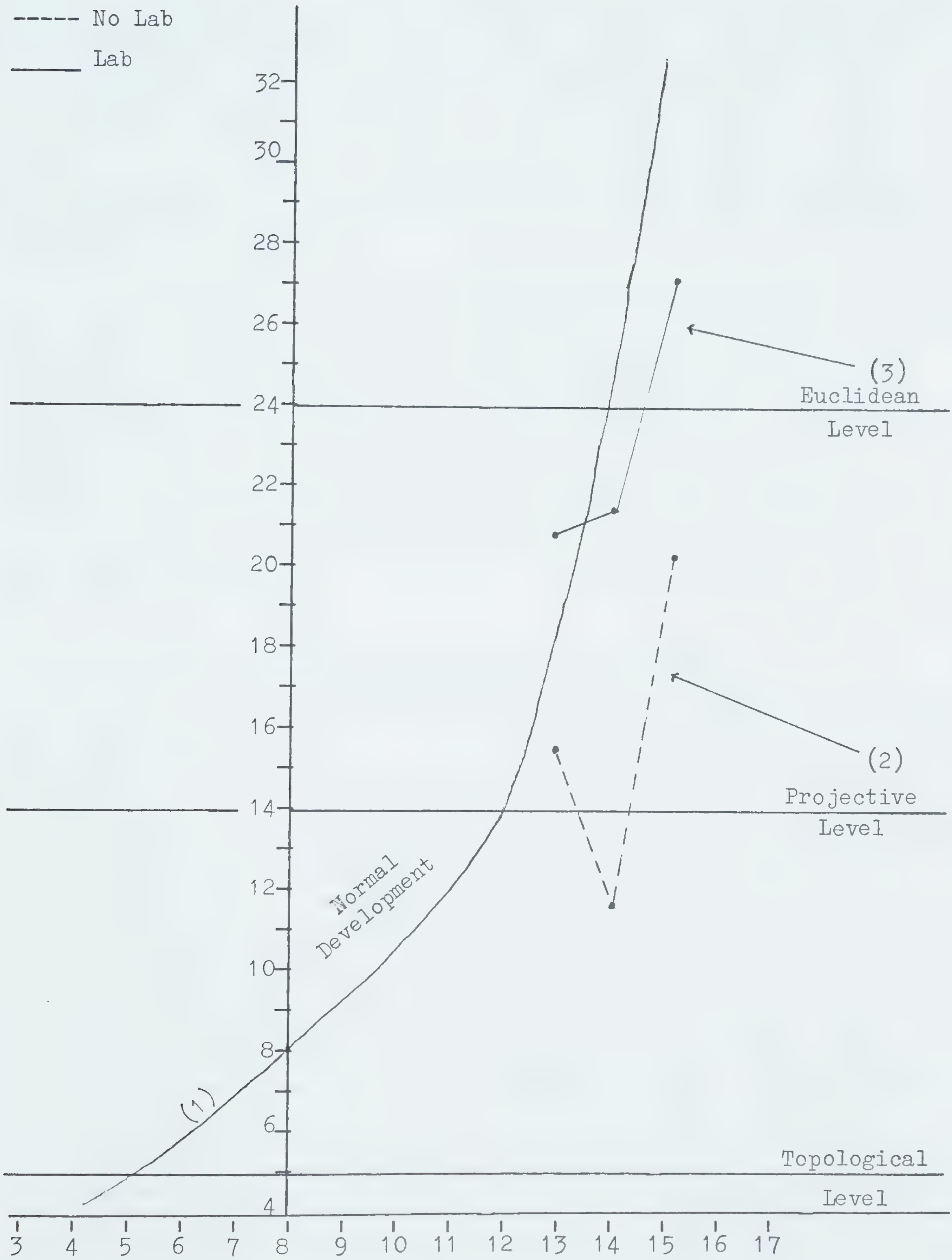
TABLE XXX

Total Population Cell Means

	No Lab	Lab
7	15.43	20.44
8	11.46	21.11
9	20.31	27.00

FIGURE 1

Profile



The profile indicates that students have not reached the euclidean level. A rich experience in projective and euclidean geometry at all grade levels have greatly increased their ability. The grade nines have reached the euclidean level on the assumption that the average score of 24 indicates this level has been reached. (Davis, 1970) This indicates strongly that these students lacked such experiences, but had the maturity level.

It is of interest to note that students at grade 8 were at a lower level than grade 7. However, laboratory experience benefitted them most. This may be that they had a higher maturity level than grade 7. Perhaps the low scores of the non-laboratory students represent students' confused efforts to represent reality on the basis of a more mature viewpoint.

V. Educational Implications and Recommendations

On the basis of this investigation, the writer strongly recommends the following.

1. We examine the order of presentation of our geometry at the elementary and junior high school level. The present practice in the elementary grades of teaching that geometric ideas (lines, triangles, squares) are sets of points should be examined. If Piaget is correct, it is purely rote to talk of a line as an infinite set of points to the elementary children. Children will just memorize definitions for rays, line segments, triangles. Children should begin with three dimensional geometry which they can manipulate. The concepts of area and volume, which are

euclidean concepts, should be delayed until the students are ready for it.

2. We provide an informal experience in geometry at the right level (when the child is old enough) and where he is allowed to operate on the objects used.
3. We provide mathematics laboratory experiences on a regular basis. The learning of mathematical concepts is still an individual process and occurs at a different point in time for each child. Materials in a laboratory setting are necessary and therefore provide the child with the opportunity to operate on objects to develop abstract ideas.
4. Geometry must be geared to the reasoning of children and not the formalism of adults so frequently occurring in texts.

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APPENDIX

APPENDIX 1

PRETEST

Id. No.	School	Grade	Sex	Age	I.Q.	Test	Lab	Tri-angular Prism				Para-llel-piped				Cube				Cone				Tri-angular Prism				Para-llel-piped				Cube				Cone				Diagram	Multiple Choice	Total
								T	L	O	P	P	O	T	L	O	T	L	P	L	P	T	O	T	L	O	P	P	O	T	L	O	T	L	P	L	P	T	O			
1	1	9	M	15-2	105	1	N	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	10	15	25
2	1	9	M	15-5	114	1	N	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	13	14	27
3	1	9	M	15-3	112	1	N	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	13	14	27
4	1	9	M	14-0	113	1	N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	16	14	30
5	1	9	M	14-9	108	1	N	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	5	4	9
6	1	9	M	14-4	113	1	N	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	4	4	8
7	1	9	M	14-3	106	1	N	1	1	0	1	0	0	0	0	0	1	1	1	1	1	0	1	1	0	0	1	0	0	0	1	1	1	1	1	1	1	0	0	9	9	18
8	1	9	M	14-2	121	1	N	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	13	13	26
9	1	9	F	15-1	103	1	N	1	1	0	0	0	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	1	1	1	1	1	1	0	11	11	22
10	1	9	M	15-1	102	1	N	1	1	0	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	12	13	25
11	1	9	F	15-3	120	1	N	1	1	0	1	0	0	0	1	0	1	1	1	0	1	0	0	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	0	8	11	19
12	1	9	M	14-7	99	1	N	1	1	0	1	0	0	0	1	0	0	0	1	1	1	1	1	1	1	0	1	0	1	0	1	0	0	1	0	1	1	0	1	9	9	18
13	1	9	F	14-6	83	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0	0	1	3	6	9
14	1	9	F	15-9	104	1	N	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	1	0	1	1	1	1	0	0	0	0	1	0	1	5	9	14
15	1	9	M	14-4	133	1	N	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	14	13	27
16	1	9	F	15-1	113	1	N	1	1	0	0	0	0	0	0	0	1	1	1	0	1	1	0	1	1	1	1	1	0	0	1	0	1	0	0	0	1	1	1	8	10	18
17	1	9	F	14-5	109	1	N	0	1	0	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	1	1	1	0	10	10	20
18	1	9	F	14-11	95	1	N	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	1	1	0	1	3	8	11
19	1	9	F	15-3	105	1	N	1	1	0	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	0	1	0	1	1	1	0	1	1	1	0	1	0	1	11	11	22
20	1	9	M	14-6	114	1	N	0	1	0	0	1	0	1	0	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1	1	10	12	22

21	1	9	M	15-2	114	1	N	1 1 0 0 1 0 1 1 0 1 0 0 1 1 1 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 1	10	12	22
22	1	9	F	14-7	110	1	N	1 1 0 0 1 0 0 0 0 1 1 1 0 1 1 1 1 1 0 1 1 0 0 1 0 1 0 0 1 1 1 1	9	10	19
23	1	9	F	14-5	78	1	N	1 1 0 1 0 0 0 0 1 0 0 1 0 1 0 0 1 0 0 0 0 0 0 1 0 1 0 1 0 1 1 1	6	7	13
24	1	9	F	14-2	90	1	N	1 1 0 0 0 0 0 0 0 1 0 0 1 1 1 0 1 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0	6	4	10
25	1	9	M	15-9	114	1	N	1 1 0 1 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1	12	14	26
26	1	9	M	14-6	111	1	N	0 1 0 0 1 0 1 0 0 1 1 1 1 1 1 0 1 1 1 1 0 0 0 1 0 1 1 1 1 1 1 0	9	11	20
27	1	9	M	14-5	118	1	N	1 1 0 1 0 0 0 1 0 1 0 0 1 1 1 1 1 1 0 0 0 0 0 1 0 1 0 0 1 1 1 0	9	7	16
28	1	9	M	14-5	121	1	N	1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 0 1 0 0 1 1 0 1 1 0 1 1 1 1 1 1 0	13	11	24
29	1	9	M	14-7	113	1	N	1 1 1 1 1 1 1 1 0 0 0 0 1 1 0 1 1 1 0 1 0 0 1 1 0 1 1 1 1 1 1 1	11	12	23
30	1	9	M	15-2	103	1	N	1 1 0 1 1 0 0 0 0 1 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 1 1 1 1 0 1 0	7	9	16
31	1	9	F	14-4	120	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 0 0 0 1 0 0	3	5	8
32	1	9	F	14-6	106	1	N	1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 0 1 1 1 1 1 0 0 1 0 1 1 1 1 1 1 1	11	13	24
33	1	9	M	15-10	124	1	N	1 1 1 1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1	14	13	27
34	1	9	F	14-6	106	1	N	1 1 0 1 0 0 0 1 0 1 0 1 1 1 0 1 0 1 1 1 0 0 0 1 0 1 0 1 1 1 0 1	9	9	18
35	1	9	F	14-9	127	1	N	1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1	12	13	25
36	1	9	F	14-5	123	1	N	1 1 0 1 1 0 0 1 0 1 1 1 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1	11	13	24
37	1	9	F	14-10	99	1	N	1 1 0 1 0 0 0 1 0 0 0 0 1 1 1 0 1 1 1 0 0 0 0 1 0 1 0 0 1 1 1 0	7	8	15
38	1	9	M	14-4	115	1	N	1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 0 1 1 1 1 1 1 1 1 1	12	13	25
39	1	9	F	14-1	113	1	N	1 1 1 0 0 0 0 0 0 1 1 1 0 1 0 1 1 1 0 0 0 0 0 1 0 1 1 1 0 1 0 1	8	8	16
40	1	9	F	14-1	98	1	N	1 0 0 1 1 0 0 1 0 1 1 1 1 1 0 0 1 1 1 1 1 0 0 0 0 1 1 0 1 1 1 0	9	10	19
41	1	9	F	14-7	119	1	N	1 1 0 1 1 0 0 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 0 1 1 1 1 1 1 1 1 1	11	13	24
42	1	9	F	14-4	107	1	N	1 0 0 0 0 0 0 1 0 1 0 0 1 0 0 0 1 1 1 1 1 0 0 1 0 1 1 1 0 1 1 1	4	12	16
43	1	9	F	14-10	110	1	N	1 1 0 0 0 0 0 1 0 1 0 0 0 1 1 1 1 1 1 0 1 0 0 0 0 1 0 0 1 0 1 0	7	7	14
44	1	9	F	15-8	98	1	N	1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 1 0 1 0 1 0 0 1 0	3	8	11
45	1	9	F	14-0	104	1	N	1 0 0 0 0 1 0 1 0 1 1 1 1 1 0 1 1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 0	9	9	18

46	1	9	F	14-9	112	1	N	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	13	14	27
47	1	9	F	14-10	110	1	N	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	14	13	27
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49	1	9	M	14-7	124	1	N	1	0	1	1	1	1	0	0	0	1	1	1	1	1	0	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	0	0	10	8	18
50	1	9	F	14-7	108	1	N	1	1	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	1	0	0	0	0	0	1	0	1	1	1	0	1	0	0	8	7	15
51	1	9	M	14-11	110	1	N	1	1	1	1	1	0	0	0	0	1	1	0	1	1	0	0	1	1	0	1	1	0	0	1	0	1	1	0	1	1	0	0	9	9	18
52	1	9	F	14-5	109	1	N	0	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1	0	1	1	1	1	12	12	24
53	1	8	M	14-5	111	1	N	1	1	0	1	0	0	0	1	1	1	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	11	10	21
54	1	8	M	14-2	107	1	N	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	0	1	1	0	0	0	0	0	1	0	1	0	0	1	1	0	0	8	6	14
55	1	8	M	13-11	113	1	N	1	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1	1	0	5	6	11
56	1	8	M	13-0	133	1	N	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	0	1	0	0	1	1	1	1	1	0	1	12	11	23
57	1	8	F	13-10	101	1	N	1	1	0	0	0	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	6	7	13
58	1	8	F	13-8	125	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	1	0	1	1	0	1	0	0	0	0	0	1	1	1	1	1	1	0	10	9	19
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60	1	8	M	14-6	109	1	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	4	5
61	1	8	F	13-8	100	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0	1	1	0	0	1	0	1	1	0	1	0	0	1	1	0	1	9	9	18
62	1	8	F	13-3	124	1	N	1	1	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	1	6	5	11
63	1	8	M	13-9	97	1	N	1	1	1	0	0	1	0	0	0	1	0	0	1	1	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	7	5	12
64	1	8	M	14-5	90	1	N	1	1	0	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	0	0	0	1	0	1	1	0	0	1	0	0	11	7	18
65	1	8	M	14-4	107	1	N	1	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	5	5	10
66	1	8	M	13-11	107	1	N	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	4	4	8
67	1	8	M	13-4	118	1	N	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1	0	0	3	6	9
68	1	8	M	13-9	117	1	N	1	1	0	1	0	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	6	3	9
69	1	8	M	13-7	123	1	N	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	5	3	8
70	1	8	F	13-7	121	1	N	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	13	11	24

71	1	8	F	14-0	124	1	N	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	1	1	1	1	0	1	13	8	21
72	1	8	F	13-6	125	1	N	1	1	1	0	0	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1	0	1	1	1	0	1	0	1	11	8	19
73	1	8	F	13-5	127	1	N	1	0	0	1	0	0	0	1	0	1	1	1	0	1	1	1	1	1	0	0	0	0	0	1	0	0	1	1	0	1	1	1	9	8	17
74	1	8	F	14-0	99	1	N	1	1	0	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1	0	10	8	18
75	1	8	F	13-8	117	1	N	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	0	1	1	0	1	0	0	0	1	0	1	1	1	1	1	1	0	10	10	20
76	1	8	F	13-8	118	1	N	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	0	0	0	0	0	1	0	1	1	0	1	1	0	1	12	8	20
77	1	8	F	13-6	108	1	N	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	0	0	1	1	0	1	1	1	1	1	1	1	13	12	25
78	1	8	F	14-0	126	1	N	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	0	1	1	1	13	11	24
79	1	8	M	14-0	119	1	N	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	12	12	24
80	1	8	M	13-9	104	1	N	1	0	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	1	0	1	0	0	0	1	1	0	1	1	0	1	0	1	7	9	16
81	1	8	M	13-9	123	1	N	1	1	0	1	0	0	0	1	0	1	0	1	0	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	0	1	1	1	9	10	19
82	1	8	F	13-8	131	1	N	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	1	0	0	1	1	1	5	8	13
83	1	8	F	14-3	95	1	N	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	5	6	11
84	1	8	M	14-7	92	1	N	1	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	0	0	0	1	1	0	0	4	6	10
85	1	8	M	13-3	111	1	N	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	5	5	10
86	1	8	M	14-3	109	1	N	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	5	12	17
87	1	8	F	13-6	103	1	N	1	1	1	1	0	0	0	1	0	1	1	1	0	0	0	0	1	1	0	1	1	0	0	1	0	0	0	0	0	1	0	1	8	7	15
88	1	8	F	14-3	75	1	N	1	1	0	1	0	1	0	0	0	1	1	1	1	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	1	0	0	1	8	7	15
89	1	8	F	14-11	88	1	N	1	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	5	5	10
90	1	8	M	13-4	110	1	N	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	3	5	8
91	1	8	M	13-5	106	1	N	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	4	5	9
92	1	8	M	13-7	96	1	N	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	1	0	0	1	0	0	1	0	1	1	0	0	1	0	1	6	8	14
93	1	8	M	13-3	109	1	N	1	1	0	1	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1	0	1	0	0	1	1	1	0	1	0	0	7	6	13
94	1	8	F	14-4	88	1	N	1	1	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	5	4	9
95	1	8	M	14-8	95	1	N	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	1	1	0	0	1	0	1	1	1	1	0	0	1	5	10	15

96	1	8	M	13-3	87	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 1 1 0 0 1 1 0	3	6	9
97	1	8	F	14-0	100	1	N	1 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0 1 1 0 1 0 0 0 1 0 1 1 0 0 0 0 0	5	6	11
98	1	8	F	13-2	105	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 1 0 0 0 0 0	4	5	9
99	1	8	M	13-5	117	1	N	1 1 0 1 1 0 0 1 0 1 1 0 1 1 0 1 1 1 1 0 0 0 0 0 0 1 0 0 1 1 1 1	10	8	18
100	1	8	M	13-6	86	1	N	1 1 0 1 0 0 0 1 0 0 1 1 0 0 0 0 0 1 0 0 0 0 0 1 0 1 1 0 0 1 0 1	6	6	12
101	1	8	M	13-5	125	1	N	1 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 1 0 1 0 0 1 1 0 0	4	6	10
102	1	8	M	14-1	112	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 1 0 0 0 1 0 1 1 0 1 1 0 0	3	7	10
103	1	8	F	13-1	92	1	N	1 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 1 0 1 0 0 0	5	6	11
104	1	8	F	13-7	121	1	N	1 1 0 1 1 1 0 0 0 0 0 0 0 1 0 1 1 1 1 1 0 0 0 0 0 0 0 0 0 1 1 1	7	7	14
105	1	8	F	13-3	100	1	N	1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 1 1 0 1 0 0 0	3	5	8
106	1	8	F	13-3	109	1	N	1 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 1 1 1 1 0 0 0 1 0 1 1 0 1 0 0 0	4	8	12
107	1	8	F	12-3	115	1	N	1 1 0 1 0 0 0 1 0 1 0 1 1 0 0 0 1 1 0 0 0 0 0 1 0 0 0 1 0 0 0 0	7	4	11
108	1	8	F	13-8	108	1	N	1 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 1 0 1 0 0 0	3	4	7
109	1	8	F	13-10	107	1	N	1 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 0 1 0 0 1 0 0	3	6	9
110	1	8	F	14-9	109	1	N	1 1 0 1 0 0 0 1 0 1 0 0 0 1 0 0 1 1 0 1 0 0 0 1 0 1 1 0 0 1 1 1	6	9	15
111	1	8	M	13-6	123	1	N	1 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1	13	13	26
112	1	8	M	13-8	113	1	N	1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1	12	13	25
113	1	8	M	14-5	119	1	N	1 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 1 0 1 1 0 1 0 0 0	5	8	13
114	1	8	M	15-0	92	1	N	1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 1 1 1 1 1 0 0	4	9	13
115	1	8	M	13-6	111	1	N	1 1 0 1 0 0 0 1 0 1 1 0 1 1 0 1 1 1 1 0 0 0 0 1 0 1 1 1 0 1 0 1	9	9	18
116	1	8	M	14-3	105	1	N	1 1 0 1 0 0 0 0 0 0 0 0 1 1 0 1 1 1 0 1 1 0 0 1 0 1 1 1 0 1 1 1	6	11	17
117	1	8	M	14-10	102	1	N	1 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 1 1 0 0 0 0 0	4	6	10
118	1	8	F	13-2	104	1	N	1 1 1 1 1 0 0 1 0 0 1 1 1 1 0 1 1 1 0 1 0 0 0 1 0 1 1 1 1 1 1 1	11	11	22
119	1	8	M	13-9	108	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 1 0 0 1 1 1 1 0 0 1 1 0 1 1 0 1 1 0 0	5	10	15
120	1	8	M	13-6	122	1	N	1 1 0 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 0	14	11	25

121	1	8	M	15-0	91	1	N	1 1 0 1 1 1 0 0 0 1 1 0 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1	10	13	23
122	1	8	M	12-5	126	1	N	1 1 0 1 1 0 0 1 0 1 1 1 1 1 0 1 1 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1	11	13	24
123	1	8	M	13-2	139	1	N	1 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1	13	13	26
124	1	8	M	13-11	106	1	N	1 1 0 1 0 0 1 1 0 1 1 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1	10	13	23
125	1	8	M	13-7	105	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 1 0 0 1 1 0 1 1 0 0 0 0 0	3	8	11
126	1	8	M	15-1	91	1	N	1 1 0 1 0 0 0 1 0 1 0 1 0 1 0 0 1 1 0 0 0 1 1 1 0 1 1 1 0 1 0 1	7	10	17
127	1	7	M	13-1	106	1	N	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 1 1 1 0 0	2	6	8
128	1	7	M	12-2	123	1	N	1 1 0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1	7	12	19
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130	1	7	M	12-4	112	1	N	0 1 0 1 0 1 0 0 0 1 1 1 1 1 0 0 1 1 1 1 1 0 0 1 0 0 1 1 1 1 0 1	8	11	19
131	1	7	F	12-8	120	1	N	1 1 0 1 0 0 0 0 0 1 0 0 1 1 0 1 1 0 0 0 0 0 1 1 0 1 1 1 1 1 0 1	7	9	16
132	1	7	M	12-4	133	1	N	1 1 0 1 1 0 1 1 0 1 1 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1	11	11	22
133	1	7	M	12-8	102	1	N	0 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 0 1 1 0 0 0 1 0 1 1 1 1 1 1 0	3	10	13
134	1	7	M	12-10	115	1	N	1 1 0 0 0 0 0 1 0 1 1 1 0 1 1 1 1 1 1 1 1 0 0 1 0 1 1 1 1 1 1 1	9	13	22
135	1	7	F	12-4	125	1	N	1 1 1 1 0 0 1 1 0 1 0 1 1 0 0 0 1 1 0 1 0 0 0 1 0 1 1 1 0 1 1 0	9	9	18
136	1	7	F	12-9	109	1	N	1 1 0 1 0 0 0 0 0 1 0 0 1 1 0 0 1 1 1 1 0 0 0 1 0 1 0 0 1 1 0 0	6	8	14
137	1	7	F	12-11	117	1	N	1 1 1 1 0 1 0 1 0 1 1 1 0 1 0 1 1 0 1 1 0 0 0 1 0 1 1 1 0 1 0 1	11	9	20
138	1	7	F	12-9	124	1	N	1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 0 1 1 0 1 0 0 0 1 0 1 1 1 1 1 1 0	9	10	19
139	1	7	F	12-3	130	1	N	1 1 0 1 0 0 0 0 0 1 0 1 0 1 0 1 1 1 0 1 1 0 0 1 0 1 1 0 1 1 0 0	7	9	16
140	1	7	F	12-10	129	1	N	1 1 0 0 0 0 0 0 0 1 1 1 0 1 0 1 1 1 0 0 0 0 0 1 0 1 1 1 0 1 0 1	7	8	15
141	1	7	F	12-6	136	1	N	1 1 0 0 0 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 0 0 1 1 0 1 1 1 1 1 0 1	9	11	20
142	1	7	F	12-4	114	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0	4	3	7
143	1	7	F	13-1	106	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 1 0 0 0 1 0 0	3	6	9
144	1	7	M	12-7	111	1	N	0 1 0 0 1 1 0 0 0 1 0 0 0 0 0 0 1 1 0 1 0 1 0 0 0 1 0 1 0 0 0 0	4	6	10
145	1	7	M	12-11	110	1	N	0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0	1	2	3

146	1	7	F	12-3	136	1	N	1 1 0 1 0 0 0 0 0 1 1 1 0 1 0 1 1 1 1 1 0 0 0 1 0 1 0 0 0 1 1 0	8	8	16
147	1	7	F	13-0	100	1	N	1 1 0 1 0 0 0 1 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 1 0 1 0 1 1 1 1 1	11	11	22
148	1	7	F	12-9	113	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0 1 1 0 0 0 0 0 1 0 1 1 1 0 1 0 0	4	7	11
149	1	7	F	12-8	121	1	N	0 0 0 0 0 0 0 1 0 1 1 0 0 1 0 1 1 1 0 1 0 0 0 1 0 1 1 1 0 1 0 1	5	9	14
150	1	7	F	12-11	120	1	N	1 1 1 1 1 0 0 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 0 1 0 1 1 1 1 1 0 1	12	11	23
151	1	7	F	12-5	119	1	N	1 1 1 0 0 1 0 0 0 0 0 0 0 1 0 1 1 1 0 1 0 0 0 1 0 1 1 1 1 1 1 0	6	10	16
152	1	7	F	12-10	109	1	N	1 1 1 0 0 1 0 1 0 1 0 0 0 1 0 1 1 0 1 0 0 0 0 1 0 1 1 1 0 1 1 0	8	8	16
153	1	7	F	12-4	123	1	N	1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 0 0 0 0 1 0	3	5	8
154	1	7	M	12-11	116	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 1 0 1 1 0 1 1 1 1 1 1 0	4	11	15
155	1	7	F	13-1	136	1	N	1 0 0 0 0 0 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1	9	12	21
156	1	7	F	12-11	116	1	N	1 1 0 1 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 1 1 0 0 1 0 1 1 0 1 1 0 1	5	10	15
157	1	7	M	11-11	121	1	N	1 1 0 0 0 0 0 0 0 1 1 1 1 0 1 1 1 1 1 1 0 0 0 1 0 1 1 1 1 1 1 1	8	12	20
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159	1	7	F	12-2	100	1	N	1 1 0 1 0 0 0 0 0 1 0 0 1 1 0 0 1 1 0 1 0 0 0 1 0 1 0 1 0 1 0 0	6	7	13
160	1	7	F	12-3	104	1	N	1 1 0 0 0 0 0 1 0 1 0 0 0 1 0 0 1 1 0 1 0 0 0 1 0 1 1 0 1 1 0 1	5	9	14
161	1	7	F	12-5	118	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 1 0 1 0 0 0 0	4	6	10
162	1	7	F	12-8	130	1	N	1 1 1 0 0 0 0 1 0 1 1 1 1 1 1 1 1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 1	11	10	21
163	1	7	F	12-6	120	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0	3	3	6
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165	1	7	M	12-4	97	1	N	1 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 1 0 1 1 0 0 0	5	5	10
166	1	7	F	13-7	115	1	N	1 1 0 1 0 0 0 1 0 0 0 0 0 1 1 0 1 1 1 1 0 0 0 1 0 1 0 0 0 1 1 0	6	8	14
167	1	7	M	13-1	101	1	N	0 1 0 1 0 0 0 1 0 0 0 0 0 1 0 0 1 0 1 1 0 0 1 1 0 1 0 0 0 1 1 0	4	8	12
168	1	7	M	12-5	134	1	N	1 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 1 0 1 0 0 0 0	4	6	10
169	1	7	F	13-11	126	1	N	1 1 0 1 0 0 0 1 0 1 1 1 1 1 1 0 1 1 0 1 0 0 0 1 0 1 1 1 1 1 1 1	10	11	21
170	1	7	F	12-5	117	1	N	1 1 0 0 0 0 0 1 0 1 0 0 1 1 1 0 1 1 0 0 0 0 0 1 0 1 1 1 1 1 1 1	7	10	17

171	1	7	F	12-6	103	1	N	1	1	0	0	1	0	1	1	0	1	1	1	0	1	0	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1	0	1	10	11	21
172	1	7	M	13-5	95	1	N	0	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	1	0	1	0	0	0	0	4	5	9
173	1	7	M	12-11	109	1	N	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	1	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	5	5	10
174	1	7	M	13-10	106	1	N	1	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	5	4	9
175	1	7	M	12-10	121	1	N	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	1	0	0	3	6	9
176	1	7	M	13-1	117	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	3	5	8
177	1	7	M	13-3	124	1	N	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	1	0	0	1	1	0	0	3	7	10
178	1	7	M	13-0	119	1	N	1	1	0	1	0	0	0	1	0	1	0	0	1	1	0	1	1	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	8	7	15
179	1	7	M	12-11	105	1	N	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	5	5	10
180	1	7	F	13-7	104	1	N	1	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0	1	0	1	0	1	0	0	0	0	6	6	12
181	1	7	F	12-3	108	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	1	0	0	0	3	6	9
182	1	7	M	13-1	112	1	N	1	1	0	1	0	1	0	0	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0	1	0	1	1	1	1	1	1	1	10	12	22
183	1	7	M	12-4	104	1	N	1	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	5	6	11
184	1	7	F	13-10	98	1	N	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2	3	5
185	1	7	F	12-7	117	1	N	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	2	6	8
186	1	7	M	12-4	132	1	N	0	1	1	1	1	0	1	1	0	1	0	1	0	1	0	1	1	1	0	0	0	1	1	1	0	1	1	1	1	1	0	0	10	10	20
187	1	7	F	12-8	106	1	N	1	0	0	1	0	1	0	0	0	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	8	6	14
188	1	7	M	12-11	118	1	N	1	1	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	0	5	10	15
189	1	7	F	13-7	114	1	N	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	1	0	1	1	0	1	0	0	0	4	7	11
190	1	7	F	12-3	106	1	N	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	3	3	6
191	1	7	M	15-1	89	1	N	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1	0	12	11	23
192	1	7	M	13-6	94	1	N	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	3	5
193	1	7	M	15-10	81	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	1	0	0	0	1	0	1	0	0	3	7	10
194	1	7	M	12-5	122	1	N	1	1	0	0	0	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	10	12	22
195	1	7	F	13-0	112	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	4	4	8

196	1	7	F	13-6	112	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0	3	3	6
197	1	7	F	12-7	123	1	N	1 1 0 1 1 0 1 1 0 1 0 0 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1	10	12	22
198	1	7	F	12-7	118	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0 1 1 1 1 0 0 0 0 0 0 1 0 0 1 1 0	4	7	11
199	1	7	M	12-4	97	1	N	1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 1 0 1 0 0 0 1 0 0 1 0 0 0 0 0	4	5	9
200	1	7	M	13-10	103	1	N	1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 1 1 1 0 1 1 1 1 1 1	12	13	25
201	1	7	M	12-7	107	1	N	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0	2	3	5
202	1	7	F	12-4	115	1	N	1 1 0 1 0 0 0 1 0 0 0 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 1	7	14	21
203	1	7	F	13-1	99	1	N	0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 0 0 0 0	2	4	6
204	1	7	M	12-7	102	1	N	1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0	3	3	6
205	1	7	F	12-9	119	1	N	1 1 0 1 0 0 1 0 0 1 1 1 0 1 0 0 1 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1	8	13	21
206	1	7	F	13-9	100	1	N	1 1 0 0 0 0 0 0 0 1 0 0 1 1 0 0 1 1 1 0 0 0 0 0 0 1 0 0 1 1 0 0	5	6	11
207	1	7	F	13-1	111	1	N	1 1 0 1 0 1 0 1 0 1 1 0 0 1 0 0 1 1 1 1 0 0 0 1 0 1 1 1 0 1 0 0	8	9	17
208	1	8	M	13-10	–	1	N	1 1 0 1 0 0 1 1 0 1 1 1 1 1 1 0 1 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0	5	5	10
209	1	8	F	–	–	1	N	1 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 1 0 0 0 0 0	5	5	10
210	1	8	F	13-7	–	1	N	0 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 1 0 0 0 0 0	3	5	8
211	1	8	M	17-0	–	1	N	1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 1 1 1 0 0 0 0	4	7	11
212	1	8	M	14-11	–	1	N	0 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 1 0 1 0 0 1	3	7	10
213	1	8	F	13-8	–	1	N	1 1 1 1 0 0 0 1 0 1 1 0 0 1 0 1 1 1 0 0 0 0 0 1 0 1 1 1 0 1 1 1	9	9	18
214	1	7	M	13-0	–	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1	6	12	18
215	1	7	F	12-5	–	1	N	1 1 0 1 0 0 0 1 0 1 0 0 1 1 0 1 1 1 0 0 0 0 0 0 0 1 0 1 1 1 0 1	8	7	15
216	1	7	M	13-0	–	1	N	0 0 0 1 0 1 0 0 0 1 0 0 0 0 0 0 1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0	3	3	6
217	2	9	F	15-8	83	1	N	1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0	4	3	7
218	2	9	F	14-6	112	1	N	0 1 0 1 0 0 0 1 0 1 0 0 1 1 0 0 1 1 0 1 0 1 0 0 1 0 1 1 1 0 0 1	6	9	15
219	2	9	F	14-9	122	1	N	1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0 0 1 1 1	12	11	23
220	2	9	F	14-8	100	1	N	1 1 1 1 0 0 1 0 0 1 1 1 0 1 0 1 1 1 1 0 0 0 0 1 0 1 1 1 0 1 1 0	10	9	19

221	2	9	F	15-1	118	1	N	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	0	1	1	0	1	0	0	0	1	0	1	1	1	1	1	1	0	8	10	18
222	2	9	F	14-5	99	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0	1	1	1	0	0	0	0	1	0	1	1	1	1	0	1	1	9	10	19
223	2	9	F	14-5	126	1	N	1	1	0	1	0	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	1	1	1	1	1	0	0	10	11	21
224	2	9	M	14-8	121	1	N	1	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	13	13	26
225	2	9	M	15-6	86	1	N	1	1	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	0	1	1	1	1	0	1	0	1	1	0	0	1	0	1	8	10	18
226	2	9	F	14-7	109	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	1	0	1	1	1	0	1	1	0	10	9	19
227	2	9	F	14-7	106	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0	1	1	0	1	0	0	0	1	1	1	1	1	0	1	0	0	9	9	18
228	2	9	M	15-9	106	1	N	1	0	0	0	1	1	0	1	0	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	10	12	22
229	2	9	M	14-6	114	1	N	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	0	1	11	12	23
230	2	9	M	14-2	122	1	N	1	1	0	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	11	13	24
231	2	9	M	16-5	108	1	N	0	1	0	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0	1	1	1	0	1	0	1	0	0	0	1	0	0	0	6	6	12
232	2	9	M	17-10	95	1	N	1	1	1	1	1	0	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	10	14	24
233	2	9	M	16-1	88	1	N	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	3	5	8
234	2	9	M	14-9	117	1	N	1	1	0	0	0	0	1	1	0	1	0	0	1	1	0	1	1	1	0	0	1	0	1	1	0	1	1	0	1	1	1	1	8	11	19
235	2	9	M	15-4	80	1	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	3
236	2	9	F	15-5	100	1	N	0	1	0	1	1	0	0	1	0	1	0	0	0	1	0	0	1	1	0	1	0	0	1	0	1	0	0	0	0	0	1	1	6	7	13
237	2	9	F	14-6	121	1	N	1	1	1	1	1	0	0	1	0	1	0	0	0	1	0	1	1	1	0	1	1	0	0	1	0	1	1	1	0	1	1	1	9	11	20
238	2	9	M	15-6	94	1	N	1	1	0	1	0	1	0	1	0	1	1	1	1	1	0	0	1	1	0	1	1	0	0	1	0	0	0	1	1	1	1	0	10	9	19
239	2	9	M	14-11	128	1	N	1	1	0	1	1	0	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	12	12	24
240	2	9	M	14-5	116	1	N	1	1	0	1	1	0	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	0	0	1	0	1	1	1	1	1	1	1	10	11	21
241	2	9	F	14-11	113	1	N	1	1	0	0	1	0	0	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	8	5	13
242	2	9	F	14-7	125	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	4	5	9
243	2	9	F	15-6	99	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	1	1	10	10	20
244	2	9	M	14-11	106	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0	1	1	1	1	0	0	1	0	0	1	1	1	1	1	0	1	9	11	20
245	2	9	F	16-7	95	1	N	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	1	11	12	23

246	2	9	F	16-1	103	1	N	0	0	0	1	0	1	0	1	0	1	1	1	1	1	0	0	1	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	8	9	17
247	2	9	M	14-10	104	1	N	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	3	4	7
248	2	9	F	15-1	110	1	N	1	1	0	1	1	0	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1	0	11	11	22
249	2	9	F	15-4	102	1	N	1	1	0	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	0	1	0	1	0	1	0	1	1	0	1	1	1	1	11	11	22
250	2	9	F	14-6	103	1	N	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0	1	1	0	0	0	0	0	1	0	1	1	1	0	1	1	0	6	8	14
251	2	9	M	14-9	106	1	N	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	13	14	27
252	2	9	M	14-6	122	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	1	0	0	1	1	0	1	0	0	0	1	1	0	5	8	13
253	2	9	F	15-4	111	1	N	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	1	1	0	0	1	0	0	1	0	0	1	0	1	1	1	0	7	8	15
254	2	9	F	14-10	101	1	N	1	1	0	1	0	0	0	1	C	0	0	1	1	1	1	0	1	1	1	1	0	0	0	1	0	0	0	1	1	1	1	1	8	10	18
255	2	9	F	14-11	101	1	N	0	1	1	1	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0	1	0	1	1	1	1	1	0	0	10	10	20
256	2	9	F	15-9	80	1	N	1	1	0	1	0	0	0	0	0	1	0	0	1	1	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	7	5	12
257	2	9	M	13-5	152	1	N	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	14	14	28
258	2	9	F	15-4	114	1	N	1	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	1	0	0	0	0	1	0	1	1	0	1	1	1	0	11	8	19
259	2	9	F	15-2	116	1	N	1	1	0	0	0	0	0	1	0	1	1	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	1	0	1	1	1	0	8	8	16
260	2	9	M	14-9	106	1	N	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4
261	2	9	F	14-11	106	1	N	1	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	0	1	1	1	1	1	1	1	13	12	25
262	2	9	M	14-7	122	1	N	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	11	11	22
263	2	9	M	14-9	112	1	N	1	1	1	1	1	0	0	1	0	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	1	1	1	1	1	1	1	12	12	24
264	2	9	M	14-11	110	1	N	1	1	1	1	0	0	0	0	0	1	0	0	1	1	0	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	0	1	7	9	16
265	2	9	M	15-5	99	1	N	1	1	1	1	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	1	1	0	0	1	0	1	0	1	1	0	0	0	7	8	15
266	2	9	M	14-9	109	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	3	4	7
267	2	9	M	15-4	106	1	N	1	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1	0	0	5	6	11
268	2	9	M	14-8	107	1	N	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	0	9	10	19
269	2	9	F	14-9	98	1	N	1	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0	1	0	1	1	1	0	1	0	1	8	8	16
270	2	9	F	14-11	103	1	N	1	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	1	0	1	1	1	6	8	14

271	2	9	F	14-3	109	1	N	1	1	0	1	0	0	0	0	0	1	1	1	1	1	0	0	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	1	8	10	18
272	2	9	F	14-9	91	1	N	1	1	0	1	0	1	0	1	0	0	0	0	0	1	1	1	0	1	0	1	1	1	0	0	0	1	1	0	1	1	0	1	8	9	17
273	2	9	F	15-8	100	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	1	0	0	3	5	8
274	2	9	F	15-5	97	1	N	1	1	0	1	0	0	0	0	0	1	1	0	1	1	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	1	0	8	9	17
275	2	8	F	13-7	97	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	1	0	1	0	4	7	11
276	2	8	M	13-8	121	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	4	5	9
277	2	8	F	13-4	121	1	N	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	5	6	11
278	2	8	M	13-11	101	1	N	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	1	0	1	2	7	9
279	2	8	M	14-11	99	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	4	5	9
280	2	8	M	14-1	108	1	N	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	3	5
281	2	8	M	13-6	118	1	N	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0	0	1	1	0	1	1	1	1	1	0	1	11	11	22
282	2	8	M	13-11	113	1	N	1	1	1	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	0	0	12	11	23
283	2	8	F	13-6	114	1	N	1	1	0	1	1	0	0	0	0	1	1	0	1	1	0	1	1	1	1	0	0	0	0	0	0	1	0	0	1	0	0	1	9	6	15
284	2	8	F	14-0	90	1	N	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	5	4	9
285	2	8	F	13-6	109	1	N	1	1	0	1	0	0	0	0	0	1	0	1	0	1	0	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	0	7	10	17
286	2	8	M	13-7	120	1	N	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	5
287	2	8	F	13-9	102	1	N	1	1	0	0	0	1	0	1	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	10	9	19
288	2	8	F	13-11	123	1	N	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	1	0	1	1	1	1	1	0	0	12	9	21
289	2	8	F	13-9	108	1	N	0	1	0	1	0	0	0	1	0	0	0	1	1	1	0	0	1	1	1	0	0	0	0	1	0	1	1	0	1	1	0	0	6	8	14
290	2	8	F	13-4	95	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	1	1	0	4	6	10
291	2	8	F	13-7	100	1	N	1	1	0	1	0	0	0	1	0	1	1	0	0	0	0	0	1	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	6	6	12
292	2	8	M	13-4	105	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	4	4	8
293	2	8	M	15-1	112	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	1	0	1	1	1	0	1	0	1	4	10	14
294	2	8	M	13-6	90	1	N	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	5	5	10
295	2	8	M	13-8	121	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	4	4	8

296	2	8	M	14-3	93	1	N	0	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	0	0	8	8	16
297	2	8	M	13-6	130	1	N	1	1	0	1	0	0	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	10	11	21
298	2	8	M	14-1	119	1	N	1	1	0	1	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	1	0	0	0	1	0	1	1	0	1	0	1	1	8	8	16
299	2	8	F	14-1	113	1	N	1	1	0	1	1	1	0	1	0	1	1	1	1	0	0	0	1	1	1	1	0	0	0	1	0	1	1	1	1	1	0	1	10	11	21
300	2	8	F	13-8	101	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	4	3	7
301	2	8	F	13-4	113	1	N	1	1	0	1	0	0	1	1	0	1	0	1	0	0	0	0	1	1	1	1	0	0	0	1	0	1	0	0	0	1	0	1	7	8	15
302	2	8	F	14-5	98	1	N	1	1	1	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	0	1	1	0	0	1	0	1	1	1	0	1	1	0	12	10	22
303	2	8	F	14-0	108	1	N	1	1	0	1	0	0	0	1	0	1	0	0	1	1	0	0	1	1	0	1	0	0	0	1	0	1	0	1	1	0	0	1	7	8	15
304	2	8	F	13-9	116	1	N	1	1	0	1	0	0	0	1	0	1	0	0	1	1	0	0	1	1	0	1	0	0	0	1	0	1	0	0	1	1	1	0	7	8	15
305	2	8	F	13-5	113	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	3	6
306	2	8	M	13-10	105	1	N	1	1	0	0	0	0	0	0	0	1	1	0	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	6	4	10
307	2	8	F	13-6	101	1	N	1	1	1	0	0	0	0	1	0	1	1	0	0	1	0	1	1	1	0	0	0	0	0	1	0	1	1	0	0	1	1	1	8	8	16
308	2	8	F	14-4	73	1	N	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	3	4	7
309	2	8	F	13-8	113	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0	1	1	1	0	1	0	1	5	7	12
310	2	8	F	14-0	91	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	4	4	8
311	2	8	F	14-3	98	1	N	1	1	0	1	0	0	0	0	0	1	0	1	1	0	0	1	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	7	5	12
312	2	8	F	15-2	101	1	N	1	1	0	0	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0	1	0	1	1	1	1	1	1	1	9	12	21
313	2	8	M	13-11	101	1	N	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	1	1	0	0	1	1	0	0	1	0	1	1	0	0	5	9	14
314	2	8	M	14-4	105	1	N	1	1	1	1	0	0	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	11	13	24
315	2	8	M	15-6	85	1	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	2
316	2	8	F	14-10	81	1	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
317	2	8	F	14-2	89	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	3	3	6
318	2	8	F	15-9	82	1	N	1	1	1	1	1	1	0	1	0	1	1	1	1	0	0	0	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0	11	9	20
319	2	8	M	16-2	77	1	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	4	5
320	2	8	F	15-0	92	1	N	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	6	5	11

321	2	8	M	13-4	116	1	N	0	1	1	1	1	0	1	1	0	1	1	1	1	1	0	0	1	1	0	1	1	0	0	1	0	1	0	1	1	0	0	1	11	9	20
322	2	8	F	14-0	102	1	N	1	1	0	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	1	1	1	6	7	13
323	2	8	M	13-11	94	1	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	3
324	2	8	M	14-4	118	1	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	6
325	2	8	F	15-3	103	1	N	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1	0	0	4	6	10
326	2	8	M	13-3	112	1	N	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	0	1	0	1	1	0	1	1	0	1	12	11	23
327	2	8	F	13-3	99	1	N	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	2	4	6
328	2	8	M	13-4	108	1	N	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	1	0	0	2	6	8
329	2	8	F	15-2	105	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	10	14	24
330	2	8	M	13-7	102	1	N	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	4	4	8
331	2	8	M	14-5	92	1	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	1	4	5
332	2	8	F	14-7	100	1	N	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	7	5	12
333	2	8	M	14-7	95	1	N	1	1	1	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1	1	12	12	24
334	2	8	M	13-11	90	1	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	3
335	2	8	M	13-4	102	1	N	1	1	0	1	0	0	0	1	0	1	1	1	1	1	0	0	1	1	0	1	0	0	0	1	0	0	0	1	0	1	0	0	9	6	15
336	2	8	M	15-0	100	1	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	5	5
337	1	8	M	13-8	115	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	4	4	8
338	2	8	M	14-6	98	1	N	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	5	2	7
339	2	8	M	13-9	87	1	N	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	1	0	0	5	6	11
340	2	8	M	14-7	87	1	N	1	1	1	0	0	0	0	1	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1	10	6	16
341	2	8	M	14-9	84	1	N	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	4	4	8
342	2	8	M	14-6	101	1	N	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	1	0	0	1	0	0	1	0	1	0	1	1	1	0	1	6	9	15
343	2	8	F	14-10	102	1	N	0	1	0	1	1	1	0	1	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	1	0	1	0	0	1	0	0	0	6	6	12
344	2	8	M	14-3	109	1	N	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	3	4	7
345	2	8	M	13-9	114	1	N	1	1	1	1	1	0	0	0	0	1	0	0	0	1	0	0	1	1	0	1	0	0	1	0	0	1	0	0	0	1	0	0	7	6	13

346	2	8	F	14-6	77	1	N	1 1 0 1 0 0 0 0 0 1 1 0 0 0 0 0 1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0	5	4	9
347	2	8	F	14-4	102	1	N	0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0	2	3	5
348	2	8	M	14-7	103	1	N	1 1 0 0 0 0 0 0 0 1 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 1 0 0 0	4	5	9
349	2	8	F	14-6	101	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0	3	3	6
350	2	8	F	14-4	95	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0	3	4	7
351	2	8	F	13-7	106	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0	4	3	7
352	2	8	M	14-9	92	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 1 0 0 1 0 0 0 1 0 0	4	5	9
353	2	8	M	14-0	113	1	N	1 1 1 1 1 0 0 0 0 1 0 0 0 0 0 1 0 1 0 1 0 0 0 0 1 0 0 0 1 1 0 1	7	6	13
354	2	8	M	13-4	113	1	N	0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 1 1 1 1 0 0 0	1	6	7
355	2	8	M	13-8	101	1	N	1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 1 0 0 0 1 0 1 0 0 1 0 0 0	2	6	8
356	2	8	F	14-10	75	1	N	1 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0	3	2	5
357	2	8	F	15-11	82	1	N	0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0	2	4	6
358	2	8	F	14-1	90	1	N	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0	0	2	2
359	2	8	F	15-0	86	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0	4	3	7
360	2	8	F	15-4	105	1	N	1 0 0 1 0 0 0 1 0 1 0 0 0 1 0 0 0 1 0 1 0 0 0 1 0 1 0 0 0 1 0 0	5	5	10
361	1	8	F	13-11	99	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0	4	4	8
362	2	8	F	14-4	107	1	N	1 0 0 1 0 0 0 1 0 1 0 1 1 0 0 0 1 0 0 1 0 0 0 1 0 1 1 0 1 1 0 0	6	7	13
363	2	8	M	15-3	83	1	N	1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 1 0 1 0 0 0 0 0 0	2	6	8
364	2	8	M	13-5	95	1	N	1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0	2	3	5
365	2	7	F	12-10	121	1	N	1 1 1 1 1 0 0 1 0 1 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 1 1 0 0 1 0 0	7	5	12
366	2	7	M	12-11	93	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 0 0 0 0	4	4	8
367	2	7	F	12-4	98	1	N	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 0 1 0 1 1 1 0 1	0	9	9
368	2	7	F	12-6	120	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0 1 1 0 1 1 0 0 1 0 1 1 1 1 1 1 0	4	11	15
369	2	7	F	11-9	93	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0	3	3	6
370	2	7	M	12-5	114	1	N	1 1 0 1 1 0 0 1 0 1 0 1 0 1 0 1 1 0 1 1 0 0 0 1 0 1 1 1 1 0 0 0	9	8	17

371	2	7	M	13-4	99	1	N	1 1 0 0 0 0 0 1 0 1 1 1 1 1 0 1 1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 0	9	9	18
372	2	7	M	12-8	129	1	N	1 1 0 1 0 0 0 0 0 1 1 0 1 0 0 0 1 1 0 1 0 0 0 0 0 1 0 0 1 0 0 0	6	5	11
373	2	7	F	14-5	83	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 0 0 0 0	3	4	7
374	2	7	F	12-8	124	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 1 0 0 0 0 0 1 0 0 1 0 0 0	3	5	8
375	2	7	F	12-4	110	1	N	1 1 0 1 0 0 0 0 0 1 0 0 1 1 0 0 1 1 0 0 0 0 0 1 0 1 0 0 1 1 0 0	6	6	12
376	2	7	F	13-0	106	1	N	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0	2	1	3
377	2	7	F	14-2	97	1	N	1 1 0 0 0 0 0 0 0 1 0 0 1 1 0 0 1 1 1 0 0 0 0 1 0 1 0 0 1 0 0 0	5	6	11
378	2	7	F	14-3	110	1	N	1 1 0 0 0 0 0 0 0 0 1 0 1 1 1 1 1 0 0 0 0 0 0 1 0 1 0 0 1 1 1 0	7	6	13
379	2	7	F	12-11	110	1	N	1 1 0 1 0 0 0 0 0 1 0 0 1 1 0 0 1 1 0 1 0 0 0 0 0 1 0 0 0 0 1 0	6	5	11
380	2	7	F	12-6	133	1	N	1 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0	3	4	7
381	2	7	M	12-5	106	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 1 0 0 0	4	5	9
382	2	7	M	13-2	133	1	N	1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1 1 1 1 1 1 0 1 1 0 1 1 0 1 1 1 1	12	13	25
383	2	7	M	14-4	91	1	N	1 1 0 1 1 1 0 0 0 0 1 1 1 1 0 1 1 1 0 1 1 0 0 1 0 1 1 1 1 1 0 1	10	11	21
384	2	7	M	12-11	116	1	N	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0	1	4	5
385	2	7	M	13-1	114	1	N	1 1 0 1 0 0 0 1 0 0 0 0 1 1 0 1 1 0 0 1 0 0 0 1 0 0 0 0 0 1 0 1	7	5	12
386	2	7	M	14-2	108	1	N	1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 1 1 0	9	4	13
387	2	7	M	13-1	98	1	N	1 0 0 0 0 1 0 1 0 0 0 1 1 1 1 1 1 1 0 1 1 0 0 1 0 1 1 0 1 1 1 1	8	11	19
388	2	7	M	13-0	127	1	N	1 1 0 1 0 0 1 0 0 1 1 1 1 1 0 0 1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1	9	12	21
389	2	7	M	12-10	105	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 1 0 0 0 1 0 1 0 0 0 1 0 0	4	6	10
390	2	7	F	13-2	107	1	N	1 1 0 1 0 0 0 0 0 1 0 0 1 0 0 0 1 1 0 1 0 0 0 1 0 1 1 0 1 1 0 0	5	8	13
391	2	7	F	12-10	107	1	N	1 1 0 1 0 0 0 0 0 1 1 1 0 1 0 0 1 1 0 1 0 0 0 1 0 1 1 0 0 1 0 0	7	7	14
392	2	7	F	12-11	97	1	N	1 0 1 0 0 1 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0	5	3	8
393	2	7	F	12-10	119	1	N	1 1 0 1 0 0 0 0 0 1 0 0 1 1 0 0 1 1 1 1 0 0 1 1 0 1 0 0 1 1 0 0	6	9	15
394	2	7	F	13-1	100	1	N	1 1 0 1 0 0 1 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0	5	3	8
395	2	7	F	14-11	89	1	N	1 1 0 1 0 1 0 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 0 1 0 1 1 0 1 1 1 1	11	11	22

396	2	7	F	12-5	83	1	N	1 1 0 1 0 1 0 1 0 1 1 1 1 1 0 0 1 1 0 1 0 0 0 1 0 1 1 0 1 1 0 0	10	8	18
397	2	7	F	14-0	93	1	N	1 1 1 1 0 0 0 1 0 1 1 1 1 1 0 1 1 1 0 0 0 0 0 1 0 1 1 1 1 1 0 1	11	9	20
398	2	7	F	11-7	141	1	N	1 1 1 1 1 0 1 0 0 1 1 1 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0	12	11	23
399	2	7	F	13-0	100	1	N	1 1 0 1 0 0 0 0 0 1 1 1 1 1 0 0 1 1 0 1 0 0 0 1 0 1 1 0 0 1 0 1	8	8	16
400	2	7	M	13-10	106	1	N	1 1 0 1 1 1 1 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7	2	9
401	2	7	F	14-4	98	1	N	1 1 1 1 0 1 0 1 0 1 0 0 1 1 0 0 1 0 0 0 0 0 0 1 0 1 1 0 0 1 0 1	9	6	15
402	2	7	M	12-6	116	1	N	1 1 0 1 0 0 0 0 0 1 1 1 1 1 1 0 1 1 1 1 0 0 0 1 0 1 1 1 0 1 0 0	9	9	18
403	2	7	M	13-2	107	1	N	1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 1 0 0 0 0 0 0	4	5	9
404	2	7	F	13-5	106	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 1 1 0 1 1 1 1 0 1 1 0 0 1 0 0	5	9	14
405	2	7	F	15-1	95	1	N	1 1 0 1 1 0 1 1 0 1 1 1 1 1 1 0 1 1 0 1 0 0 0 1 0 1 1 1 1 1 1 0	12	10	22
406	2	7	M	13-8	90	1	N	1 1 1 0 1 1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0	6	2	8
407	2	7	M	13-8	101	1	N	0 1 0 0 0 0 0 1 0 1 1 1 1 0 1 0 1 1 0 0 1 0 1 0 0 1 1 0 0 0 1 0	7	7	14
408	2	7	M	12-4	108	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 0 0 0 0	3	4	7
409	2	7	M	12-4	118	1	N	1 1 0 1 0 0 0 1 0 1 1 1 0 1 0 0 1 1 1 1 0 0 0 1 0 0 1 1 0 1 0 0	8	8	16
410	2	7	M	13-5	90	1	N	1 1 0 1 0 0 0 0 0 1 0 0 1 0 0 0 1 1 0 1 0 0 0 1 0 1 0 0 1 0 0 0	5	6	11
411	2	7	M	13-6	108	1	N	1 1 1 1 1 0 1 0 0 1 1 1 1 1 0 1 1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 1	12	10	22
412	2	7	M	12-7	113	1	N	1 1 0 1 0 0 0 1 0 0 0 0 1 1 0 0 1 1 1 0 0 0 0 1 0 1 1 0 1 1 0 0	6	8	14
413	2	7	M	13-3	103	1	N	1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2	0	2
414	2	7	M	14-11	83	1	N	1 1 0 1 1 0 0 1 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 1 0 0 0 0 0	6	4	10
415	2	9	F	15-4	–	1	N	1 1 0 1 0 0 0 1 0 1 0 0 1 1 0 1 1 1 0 1 0 0 0 1 0 0 1 0 0 1 1 0	8	7	15
416	2	9	F	15-1	–	1	N	1 1 0 1 0 0 0 1 0 1 1 1 0 1 0 0 1 1 1 0 0 0 0 1 0 1 1 1 0 1 0 0	7	8	15
417	2	9	F	18-8	–	1	N	1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0 1 0 0 0 0 1 0	3	6	9
418	2	9	F	14-6	–	1	N	1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 0 1 1 0 1 1 0 0 1 0 1 1 0 1 1 0 0	9	9	18
419	2	9	M	17-3	–	1	N	1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1	14	15	29
420	2	8	F	14-0	–	1	N	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 0 0 0 0	2	4	6

421	2	7	M	14-4	-	1	N	1	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	5	5	10
422	2	7	M	14-4	-	1	N	1	1	0	0	0	0	1	1	0	1	1	1	0	1	0	1	0	1	0	1	0	0	0	0	0	1	1	1	0	1	0	0	9	6	15

POSTEST

Id. No.	School	Grade	Sex	Age	I.Q.	Test	Lab	Rect. Solid				Cyl-inder				Star				Pyramid				Rect. Solid				Cyl-inder				Star				Pyramid				Diagram	Multiple Choice	Total
								T	L	O	P	P	O	T	L	L	O	P	T	P	T	L	O	T	L	O	P	P	O	T	L	L	O	P	T	P	T	L	O			
1	1	9	F	15-1	104	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	0	1	1	1	1	1	0	14	11	25
2	1	9	F	14-6	108	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	0	1	1	1	1	1	0	14	11	25
3	1	9	F	14-11	110	2	Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	16	15	31
4	1	9	F	14-7	110	2	Y	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	14	29
5	1	9	F	14-3	90	2	Y	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	12	5	17
6	1	9	M	14-7	113	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	15	13	28
7	1	9	M	14-7	121	2	Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16	15	31
8	1	9	M	15-4	124	2	Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	15	15	30
9	1	9	M	14-6	111	2	Y	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	12	13	25
10	1	9	F	14-3	99	2	Y	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	13	13	26
11	1	9	F	14-8	106	2	Y	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	0	12	11	23
12	1	9	F	14-3	127	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14	14	28
13	1	9	F	14-8	109	2	Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	15	14	29
14	1	9	F	14-9	97	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	14	12	26
15	1	9	F	14-11	113	2	Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	15	13	28
16	1	9	F	14-11	98	2	Y	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	0	13	12	25
17	1	9	F	14-3	110	2	Y	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	13	12	25
18	1	9	F	14-8	107	2	Y	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	13	14	27
19	1	9	F	15-4	98	2	Y	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	13	14	27
20	1	9	M	15-0	110	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	15	15	30

21	1	9	M	14-7	118	2	Y	1	0	0	1	1	0	1	0	0	1	1	1	0	1	0	1	1	0	0	0	1	0	1	1	1	1	1	1	0	1	0	1	9	10	19
22	1	9	M	14-6	124	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	16	31
23	1	9	M	15-5	114	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	16	31
24	1	9	F	14-7	119	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	14	14	28
25	1	9	F	14-9	112	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14	14	28
26	1	9	F	14-7	106	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	14	15	29
27	1	9	F	14-6	123	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	13	14	27
28	1	9	M	15-4	103	2	Y	1	1	1	1	0	0	0	1	1	0	1	1	1	1	1	0	1	1	0	0	0	1	0	1	1	0	1	1	1	1	1	0	11	10	21
29	1	9	M	14-5	115	2	Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	15	14	29
30	1	9	F	14-4	120	2	Y	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	0	1	0	1	1	1	1	0	0	1	1	1	1	0	11	11	22
31	1	9	F	14-6	78	2	Y	1	0	0	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	1	1	1	12	12	24
32	1	9	M	15-2	114	2	N	1	1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	7	3	10
33	1	9	M	14-4	113	2	N	1	0	0	1	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	1	0	6	5	11
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38	1	9	M	14-4	106	2	N	1	1	0	0	1	0	1	1	1	0	1	0	0	0	0	0	1	0	0	1	1	1	1	1	1	0	1	0	0	1	1	0	7	10	17
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46	1	9	M	14-3	121	2	N	1 1 0 1 0 0 0 1 0 0 1 1 0 0 0 0 1 1 0 1 1 1 0 1 1 1 1 1 0 1 0 0	6	11	17
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92	1	8	M	13-9	88	2	N	1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 1 0	2	3	5
93	1	8	F	12-10	115	2	N	1 1 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 1 0 0	4	3	7
94	1	8	F	14-2	88	2	N	1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 1 0 0 0 0 0 0 0 1 0	3	4	7
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98	1	8	F	14-8	95	2	N	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	4	4	8
99	1	8	F	14-8	75	2	N	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	3	4	7
100	1	8	F	13-5	131	2	N	1	0	0	0	1	1	1	0	0	0	0	0	1	1	1	0	1	0	0	0	1	1	1	1	0	0	0	0	1	1	1	0	7	8	15
101	1	8	F	14-8	106	2	N	1	1	0	1	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	6	2	8
102	1	8	M	13-2	87	2	N	1	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	5	4	9
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106	1	8	M	13-10	113	2	N	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	0	13	12	25
107	1	8	M	13-5	139	2	N	1	1	0	0	0	1	1	0	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	0	1	1	0	1	1	0	9	8	17
108	1	8	M	12-6	126	2	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	2
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111	1	8	M	13-7	95	2	N	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	3	2	5
112	1	8	M	13-8	122	2	N	1	1	0	0	0	0	1	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	1	1	0	9	11	20
113	1	8	M	14-0	106	2	N	1	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	11	13	24
114	1	8	M	14-3	102	2	N	1	0	0	1	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	5	3	8
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118	1	8	M	13-4	108	2	N	1	1	0	1	0	0	1	1	1	1	1	0	1	1	1	0	1	0	1	0	1	0	1	1	1	0	1	1	0	0	1	0	11	9	20
119	1	8	F	13-5	90	2	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	5	5
120	1	8	F	13-2	107	2	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	2	3

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122	1	7	M	12-7	103	2	N	1 1 0 1 1 0 1 1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0	12	15	27
123	1	7	M	12-11	115	2	N	1 1 0 1 1 1 1 1 1 0 1 1 1 1 1 0 1 1 0 1 1 1 1 0 1 1 1 0 1 1 1 0	13	12	25
124	1	7	M	12-4	133	2	N	1 1 0 0 1 0 1 1 1 0 0 1 0 1 1 0 1 0 1 1 1 1 1 1 1 0 1 0 1 1 1 0	9	12	21
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126	1	7	F	12-11	120	2	N	1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 0 1 1 0 0 1 1 1 1 1 0 1 0 1 1 1 0	14	11	25
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137	1	7	M	12-8	111	2	N	1 0 0 0 0 0 1 0 0 0 1 0 1 1 0 0 1 0 0 0 1 0 1 1 1 0 1 0 1 1 1 0	5	9	14
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139	1	7	F	12-4	114	2	N	1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0	3	2	5
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```
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147 1 7 F 13-0  125 2 N  1 1 0 1 0 1 1 0 1 0 1 0 1 1 1 0 1 0 0 1 0 1 1 0 1 1 1 1 1 1 1 0  10 11 21
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149 1 7 F 12-8  121 2 N  1 1 0 1 0 0 1 0 0 0 0 0 1 1 1 0 1 1 0 1 1 1 1 1 0 0 0 0 0 1 1 0   7  9 16
150 1 7 F 12-8  113 2 N  1 0 0 1 0 1 1 0 1 0 1 0 1 0 0 0 1 0 0 0 0 1 1 0 1 1 1 0 0 1 1 0   7  8 15
151 1 7 F 12-5  119 2 N  1 1 0 0 0 0 1 0 0 0 1 1 1 1 0 0 1 0 1 1 1 1 1 1 1 1 1 0 1 1 1 0   7 13 20
152 1 7 F 13-2  126 2 N  1 1 0 1 1 1 1 1 1 1 0 0 1 1 1 0 1 0 0 1 1 1 1 1 1 1 1 0 0 1 1 0  12 11 23
153 1 7 F 12-10 114 2 N  0 0 0 1 1 1 1 1 1 1 1 0 1 1 1 0 1 0 0 1 1 1 1 1 1 1 1 0 0 1 1 0  10 11 21
154 1 7 F 12-4  130 2 N  1 1 0 0 1 1 1 0 1 1 1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1 1 1 0 1 1 1  13 13 26
155 1 7 F 12-6  120 2 N  0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0   2  3  5
156 1 7 F 12-10 108 2 N  1 0 0 1 0 0 1 0 0 0 0 1 1 1 1 0 0 0 0 0 1 0 1 1 1 0 1 0 0 1 0 0   7  6 13
157 1 7 F 12-8  117 2 N  1 1 0 0 1 1 1 1 1 0 1 0 0 1 1 0 1 1 0 0 1 1 1 1 1 1 1 0 0 1 1 0  10 11 21
158 1 7 F 12-6  103 2 N  1 1 1 1 1 1 1 1 0 0 0 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1 0 1 1 1 1 0  12 12 24
159 1 7 M 13-0  105 2 N  1 0 0 1 0 0 0 0 0 0 1 0 0 1 0 0 1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 0   4  4  8
160 1 7 M 13-3  106 2 N  1 0 0 1 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0   4  1  5
161 1 7 F 12-11 101 2 N  0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0   1  2  3
162 1 7 F 13-3  111 2 N  1 0 0 1 1 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0   4  3  7
163 1 7 M 12-7  134 2 N  0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 0 0 1 0 0 0 0 0   2  5  7
164 1 7 M 13-4  101 2 N  1 0 0 1 0 0 1 0 0 0 0 0 0 0 1 0 1 0 0 0 1 0 1 1 0 0 0 0 0 1 0 0   4  5  9
165 1 7 F 12-8  118 2 N  0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0   1  2  3
166 1 7 F 12-11 100 2 N  1 0 0 1 0 0 1 0 0 0 0 0 1 0 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 1 1 0   5  5 10
167 1 7 M 13-5  124 2 N  1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 0 0 0 0 0 0 1 0 0   3  4  7
168 1 7 M 12-9   97 2 N  1 0 0 1 0 0 1 1 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 0 0 0 0 0 0 1 0 0   4  4  8
169 1 7 M 13-1  112 2 N  1 0 0 1 0 0 1 0 0 0 0 0 0 1 1 0 1 0 0 1 1 0 1 0 0 0 0 0 0 1 0 0   5  5 10
170 1 7 M 13-2  117 2 N  1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 0 1 0 0 0 1 0 0   3  6  9
```

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173	1	7	F	13-5	115	2	N	1 1 0 1 0 0 1 1 1 0 1 1 1 1 1 0 0 0 0 0 1 0 1 0 0 1 0 1 0 1 1 0	11	6	17
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175	1	7		13-1	119	2	N	0 0 0 1 0 0 1 0 1 1 1 0 1 0 0 0 1 1 0 1 0 1 1 0 1 1 1 0 0 0 1 0	6	9	15
176	1	7	M	11-10	121	2	N	1 1 0 0 0 1 1 1 1 0 1 1 1 1 1 0 1 1 0 1 0 1 1 1 0 1 1 1 0 1 1 0	11	11	22
177	1	7	F	13-10	100	2	Y	1 1 0 1 0 1 1 0 0 0 1 1 0 0 1 0 1 0 0 0 0 0 1 0 1 0 1 0 1 1 1 0	8	7	15
178	1	7	F	12-5	118	2	Y	1 1 1 1 0 1 1 0 1 0 1 1 1 1 1 0 1 1 0 0 0 0 1 1 1 0 1 1 1 1 1 0	12	10	22
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186	1	7	M	15-2	89	2	Y	1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 0 1 1 0 1 1 0 1 1 1 0 1 0 1 1 1 0	13	11	24
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189	1	7	F	13-1	99	2	Y	1 1 0 1 0 0 1 1 0 0 1 1 0 1 0 0 1 0 0 0 1 0 1 0 1 0 1 0 0 1 0 0	8	6	14
190	1	7	M	12-4	132	2	Y	1 1 0 1 1 1 1 1 1 0 1 1 1 1 1 0 0 1 1 0 1 1 1 1 1 0 1 1 1 1 1 0	13	12	25
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196	1	7	F	12-6	123	2	Y	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	0	14	11	25
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216	2	9	F	14-9	122	2	N	1	1	0	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1	0	12	12	24
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227	2	9	M	17-10	95	2	N	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	0	14	12	26
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230	2	9	M	15-11	80	2	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	3	4
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257	2	9	F	14-10	98	2	N	1	1	0	1	0	0	1	1	0	0	0	0	1	1	1	0	1	0	0	1	0	0	1	1	0	0	0	0	1	1	1	1	8	8	16
258	2	9	M	14-7	122	2	N	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	13	14	27
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269	2	9	F	15-3	116	2	N	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	13	13	26
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271	2	9	M	15-4	97	2	N	1 0 0 0 0 1 1 1 0 0 0 1 1 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 1 1 1	6	6	12
272	2	9	M	14-10	109	2	N	1 0 0 1 1 1 1 1 1 0 1 0 1 1 1 0 1 0 0 1 1 1 1 0 1 0 1 1 1 1 1 1	11	12	23
273	2	9	M	14-11	106	2	N	1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 0 0 1 0 0 0 0 0 0	3	4	7
274	2	9	M	14-10	112	2	N	1 0 0 1 1 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 0 1 1	4	5	9
275	2	9	M	14-9	107	2	N	1 1 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1 1 0 1 1 1 1 1 1 0 1 1 0 1 1 0	13	12	25
276	2	9	F	15-9	83	2	N	1 1 0 1 0 1 1 0 0 0 1 1 0 1 1 0 1 1 0 0 0 1 1 0 1 1 1 1 0 1 1 0	9	10	19
277	2	9	F	15-0	106	2	N	1 1 0 1 1 0 1 1 1 0 1 1 1 1 1 1 1 1 0 1 1 1 1 1 0 0 1 1 1 1 1 1	13	13	26
278	2	8	F	14-0	102	2	Y	1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 0 1 0 0 1 1 1 1 1 1 0 1 0 1 1 1 1	13	12	25
279	2	8	M	13-4	112	2	Y	1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 0 1 0 0 1 1 1 1 1 1 0 1 1 0	14	10	24
280	2	8	F	15-3	103	2	Y	1 0 0 1 1 0 1 0 1 0 1 1 1 1 0 0 1 0 0 0 1 0 1 0 1 1 0 1 0 1 0 0	9	7	16
281	2	8	M	13-4	116	2	Y	1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 1 0 1 1 1 0 1 1 1 1	15	11	26
282	2	8	M	13-11	105	2	Y	1 1 0 1 1 0 1 0 1 0 1 1 1 1 1 0 0 0 0 1 1 0 1 1 1 0 1 0 1 1 1 0	11	9	20
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284	2	8	M	14-7	95	2	Y	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1 1 1 1 1 0 1 1 1	16	12	28
285	2	8	M	15-6	85	2	Y	0 0 0 1 1 1 0 0 0 1 0 0 0 1 0 0 1 0 0 1 0 1 0 0 0 1 1 0 0 0 0 0	5	5	10
286	2	8	M	15-1	100	2	Y	0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 0 1 1 1 0 1 1 0	1	9	10
287	2	8	F	14-11	81	2	Y	1 1 0 1 0 0 1 0 0 0 0 1 1 0 1 0 1 0 0 0 0 0 0 1 0 1 1 0 0 0 1 0	7	5	12
288	2	8	M	14-4	118	2	Y	1 1 0 1 1 0 1 1 1 0 1 1 1 1 1 1 0 0 0 0 1 1 1 1 1 0 0 1 1 1 1 1	13	10	23
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290	2	8	F	14-2	89	2	Y	1 0 0 1 1 0 1 1 1 0 1 1 1 0 1 0 1 0 0 0 1 0 1 0 1 0 1 0 1 1 1 0	10	8	18
291	2	8	F	13-3	99	2	Y	1 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 0 0 0 1 1 0 1 1 1 1 1 1 1 1 1 0	13	13	26
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293	2	8	M	13-8	108	2	Y	1 1 0 1 1 1 1 1 1 0 1 1 0 1 1 1 1 1 0 1 0 0 1 0 1 0 1 1 1 1 1 0	13	10	23
294	2	8	F	14-4	98	2	Y	1 1 0 1 1 0 1 1 0 0 0 1 1 1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0	10	4	14
295	2	8	F	13-8	113	2	Y	1 0 0 1 1 1 1 1 1 0 1 1 1 1 1 0 1 0 0 1 1 0 1 1 1 0 1 0 0 1 1 0	12	9	21

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296 2 8 M 14-3   108 2 Y  1 1 0 1 1 1 1 1 1 0 1 1 1 1 1 0 1 1 0 0 1 1 1 0 1 0 1 0 0 1 1 0 13  9 22
297 2 8 M 14-4   105 2 Y  1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1 1 1 0 1 1 1 1 15 13 28
298 2 8 F 13-7   101 2 Y  1 1 0 1 0 0 1 1 1 0 1 1 1 1 1 0 1 0 0 0 1 0 1 0 1 0 1 0 1 1 1 0 11  8 19
299 2 8 F 14-5    73 2 Y  1 0 0 1 0 0 1 0 0 0 1 1 1 0 1 0 1 0 0 0 0 0 0 0 0 0 1 0 1 0 1  7  4 11
300 2 8 M 13-11   90 2 Y  1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 14 13 27
301 2 8 M 14-5    92 2 Y  1 1 0 1 1 1 1 1 1 0 1 1 1 1 1 0 0 1 0 0 1 1 1 1 1 0 1 0 0 1 1 0 13  9 22
302 2 8 M 13-8   102 2 Y  1 0 0 1 0 0 1 1 1 0 1 1 0 1 1 0 1 0 0 0 0 1 1 1 1 0 1 1 1 1 0 0  9  9 18
303 2 8 M 13-5   102 2 Y  1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 0 1 1 0 1 1 0 0 1 1 1 1 1 1 1 1 0 13 12 25
304 2 8 F 14-2   113 2 Y  1 1 0 1 1 0 1 1 1 0 1 1 1 1 1 0 1 0 0 0 1 0 1 1 1 0 1 0 1 1 1 1 12 10 22
305 2 8 F 13-5   113 2 N  1 0 0 1 0 0 1 0 0 0 0 0 0 1 0 0 1 0 0 0 1 0 1 0 0 0 1 0 0 1 0 0  4  5  9
306 2 8 F 14-11  108 2 N  1 1 0 1 0 0 1 0 0 0 0 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 0 1 0 0  5  5 10
307 2 8 M 13-8   121 2 N  1 0 0 1 0 0 1 0 0 0 1 0 0 1 0 0 1 0 0 0 0 0 1 0 0 0 1 0 0 1 0 0  5  4  9
308 2 8 M 13-7   118 2 N  1 1 0 1 1 0 1 1 1 0 1 1 1 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 1 1 1 0 12 13 25
309 2 8 F 13-8   101 2 N  1 0 0 1 0 0 1 0 0 0 0 0 0 1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0  5  3  8
310 2 8 F 14-0   123 2 N  1 1 0 1 0 0 1 1 0 0 1 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0  7  2  9
311 2 8 F 13-10  108 2 N  1 1 0 0 0 0 1 1 1 0 0 1 0 0 1 0 1 1 0 1 0 0 1 0 0 0 0 1 1 1 1 1  7  9 16
312 2 8 M 13-11   94 2 N  1 1 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0  4  3  7
313 2 8 F 13-4   113 2 N  1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0  3  3  6
314 2 8 F 13-9   116 2 N  1 0 0 1 1 0 0 0 1 0 0 1 0 1 1 0 1 0 0 0 1 0 1 0 0 0 1 1 0 1 1 0  7  7 14
315 2 8 M 13-7   130 2 N  1 1 0 1 1 0 1 1 0 0 0 1 1 1 1 0 1 0 0 0 1 0 1 1 1 1 1 0 0 1 1 0 10  9 19
316 2 8 M 13-6   105 2 N  1 0 0 1 0 0 1 0 1 0 0 0 1 1 1 0 1 0 0 0 1 0 1 0 0 1 1 0 1 1 1 0  7  8 15
317 2 8 M 13-8   121 2 N  1 1 1 1 0 0 1 0 1 1 1 0 0 0 0 0 1 0 0 0 1 0 0 0 1 0 1 0 0 1 0 0  8  5 13
318 2 8 F 13-4    95 2 N  1 0 0 1 1 1 1 0 1 0 1 0 1 1 1 1 1 0 0 1 1 1 1 1 1 0 0 0 1 1 1 1 11 11 22
319 2 8 F 13-7    97 2 N  1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  1  1  2
320 2 8 F 13-4   121 2 N  1 0 0 1 0 0 1 0 0 0 1 0 0 0 0 0 1 1 0 0 1 0 1 0 0 0 0 0 0 1 1 0  4  6 10
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321	2	8	F	13-6	109	2	N	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	1	1	1	0	4	6	10
322	2	8	F	14-1	111	2	N	1	1	0	1	0	0	1	1	1	0	1	0	1	1	1	0	1	0	0	0	1	0	1	1	1	0	1	0	1	1	1	0	10	9	19
323	2	8	F	14-0	90	2	N	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3	2	5
324	2	8	M	14-2	119	2	N	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	1	0	1	3	6	9
325	2	8	M	14-4	93	2	N	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	13
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327	2	8	M	14-11	99	2	N	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	3	3	6
328	2	8	F	14-6	98	2	N	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	13	13	26
329	2	8	M	14-0	101	2	N	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	4	3	7
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331	2	8	F	13-10	102	2	N	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	1	1	1	1	1	1	1	0	15	10	25
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333	2	8	M	13-8	115	2	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	4	4
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341	2	8	M	15-4	83	2	N	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	2	4
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343	2	8	F	14-4	102	2	N	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	2	4
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356	2	8	F	14-10	102	2	N	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	0	1	0	0	0	1	1	1	1	0	1	0	1	1	1	1	0	12	10	22
357	2	8	M	14-8	92	2	N	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	3	5	8
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364	2	7	M	12-1	108	2	Y	1	0	0	1	0	0	1	0	1	0	1	1	1	1	1	0	1	0	1	1	1	0	1	0	1	0	1	0	1	1	1	0	9	10	19
365	2	7	M	12-7	116	2	Y	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	0	1	0	1	1	1	1	0	1	1	0	13	10	23
366	2	7	M	13-7	108	2	Y	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	0	1	1	1	1	1	1	14	12	26
367	2	7	M	14-11	83	2	Y	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	0	1	0	0	1	0	0	0	1	1	0	1	1	1	1	1	0	12	9	21
368	2	7	M	13-11	90	2	Y	1	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	5	4	9
369	2	7	M	13-11	101	2	Y	1	1	0	1	0	0	1	1	1	0	1	1	1	1	1	0	1	0	0	0	1	0	1	0	1	0	1	1	0	1	1	0	11	8	19
370	2	7	M	12-8	113	2	Y	1	1	0	1	1	0	1	0	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	11	13	24

371	2	7	M	12-5	103	2	Y	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	13	13	26
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373	2	7	M	14-4	100	2	Y	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	13	13	26
374	2	7	M	13-11	106	2	Y	1	0	0	1	0	0	1	0	0	0	1	1	1	1	1	0	1	0	0	1	0	0	1	0	1	0	1	0	1	1	1	0	8	8	16
375	2	7	M	13-3	107	2	Y	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	12	13	25
376	2	7	F	11-9	141	2	Y	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	14	13	27
377	2	7	F	15-0	89	2	Y	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	16	30
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379	2	7	F	12-10	119	2	Y	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	14	14	28
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381	2	7	F	15-2	95	2	Y	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	13	14	27
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383	2	7	F	13-1	100	2	Y	1	1	0	1	0	1	1	0	1	0	1	1	1	1	1	0	1	0	0	1	0	0	1	0	1	0	1	1	0	1	1	0	11	8	19
384	2	7	F	13-0	97	2	Y	1	1	0	1	0	0	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	1	0	1	0	1	1	1	0	1	0	10	6	16
385	2	7	F	13-2	100	2	Y	1	0	0	1	0	0	1	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	1	1	1	0	0	1	1	1	0	1	6	8	14
386	2	7	F	14-0	93	2	Y	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	0	1	1	0	1	1	0	12	11	23
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388	2	7	F	14-3	104	2	N	1	1	0	1	1	0	1	0	1	1	0	0	1	0	1	0	1	0	0	0	1	1	1	1	0	1	1	0	0	1	1	0	9	9	18
389	2	7	M	12-11	110	2	N	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	2	6
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393	2	7	F	12-9	113	2	N	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	4	3	7
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396	2	7	M	13–1	91	2	N	1	1	0	1	1	0	1	1	1	0	1	0	1	1	1	0	0	1	0	0	1	0	1	1	1	0	0	1	0	1	0	0	11	7	18
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399	2	7	F	13–7	96	2	N	1	1	0	1	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	6	6	12
400	2	7	F	12–8	106	2	N	1	1	0	1	1	0	1	1	1	0	1	1	0	1	1	0	1	0	0	1	1	0	1	1	1	0	1	1	0	1	1	1	11	11	22
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404	2	7	F	12–10	116	2	N	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	0	1	0	0	0	1	1	1	1	1	0	1	1	1	1	1	0	12	11	23
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411	2	8	F	14–1	–	2	N	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	3	4	7
412	2	8	F	15–1	–	2	N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3
413	2	7	M	13–2	–	2	Y	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	0	13	11	24
414	2	7	M	12–9	–	2	N	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	1	1	0	3	6	9
415	2	7	M	12–11	–	2	N	1	1	0	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	12	14	26
416	2	7	M	13–3	–	2	N	1	1	0	1	1	0	1	1	1	0	1	0	1	1	1	1	1	0	0	0	1	0	1	0	1	0	1	1	1	1	1	1	12	10	22

APPENDIX 2

A. Shadows

Use the overhead projector and screen with the several items found in the box. You are to draw the shape you would expect the shadow to assume. Then place the item on the overhead and check the shadow against your diagram.

1. Cone: Single Nappe

	Expected Shadow	Actual Shadow on Screen
(a) upright		
(b) inverted		
(c) end-on		

2. Two nappe cone

(a) upright

(b) horizontal

3. Cone with hole

(a) upright

(b) inverted

(c) end-on

4. Carboard Disc

(a) horizontal

(b) vertical

5. Rectangle

(a) horizontal

(b) vertical

6. Bobbin

   (a) horizontal

   (b) vertical

7. Pencil

   (a) horizontal

   (b) vertical

B. Coordination of Perspectives

Before you, there is a container whose sides are labelled A, B, C, D. The model represents three mountains having certain characteristics. Notice the green mountain with its characteristic top. Look at the other two mountains and notice their distinguishing characteristics. Imagine yourself in the five positions:

Position A

Position B

Position C

Position D

Position Overhead

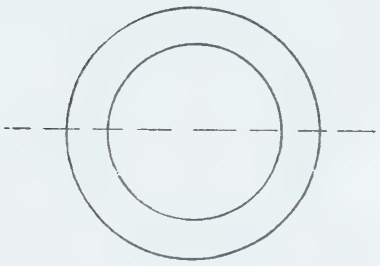
Sketch the five views on the following pages without changing your seating position. After you have made the sketches, position yourself at A, B, C, D and take the overhead view and check your perspective drawings.

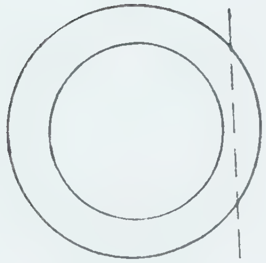
C. Geometrical Sections

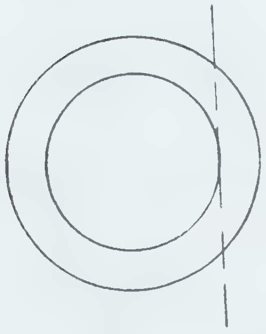
You are given six different plasticine figures. On each object you will perform certain cuts. Before you do the actual cutting, draw the shape of the plane surface you will expect to see when it is cut. Cut the object as shown by the diagram and compare your guess with the correct answer.

1. Closed circular annular ring:

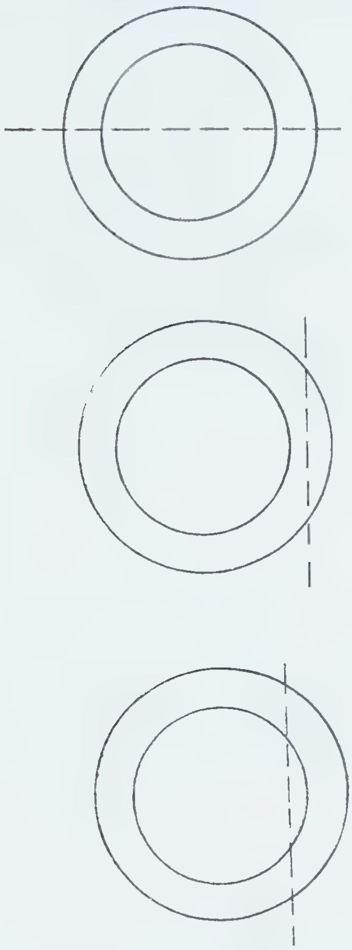
	Surface you expect to see	Actual surface as seen after the cut



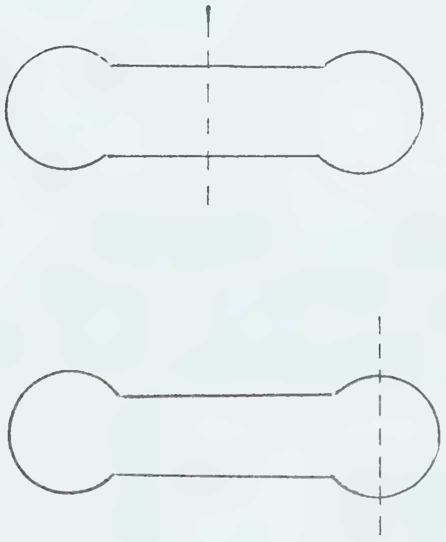


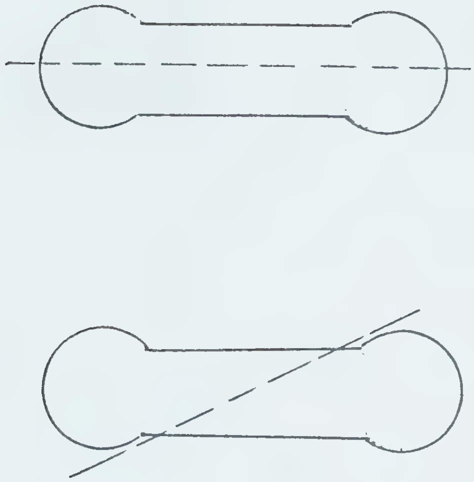


2. Closed square annular ring:

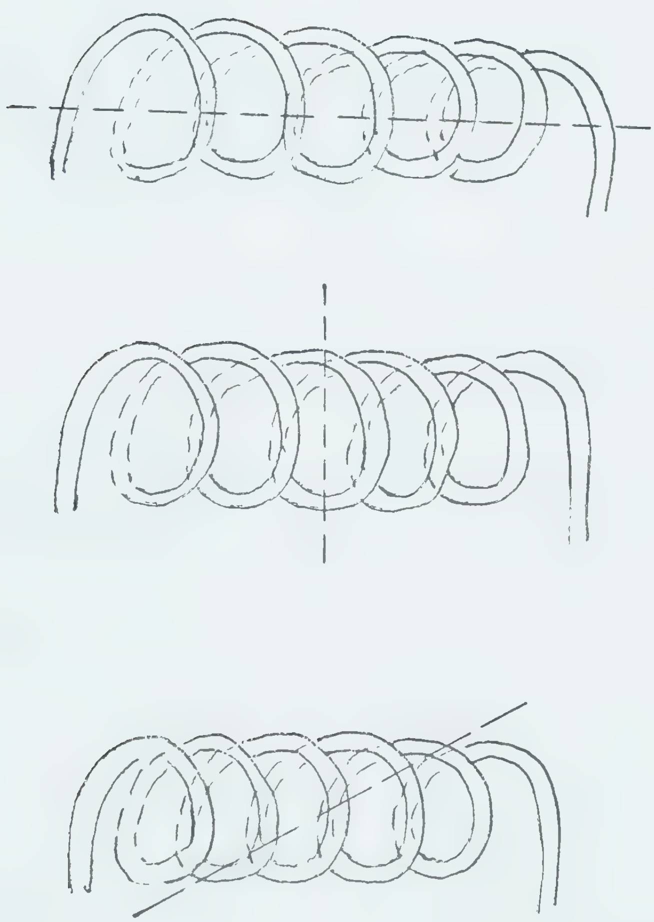


3. Dumbells (circular and square)

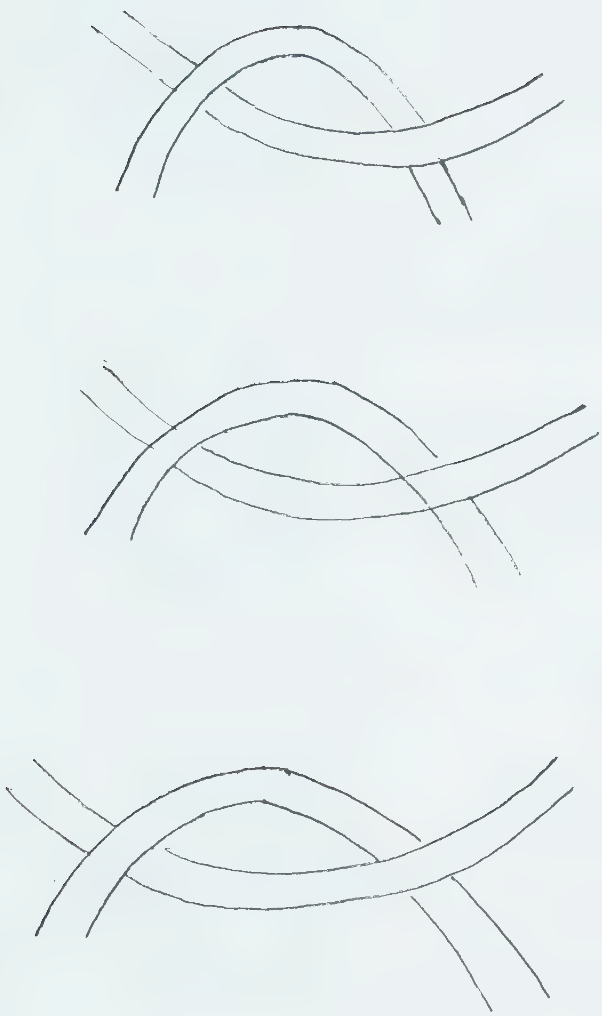




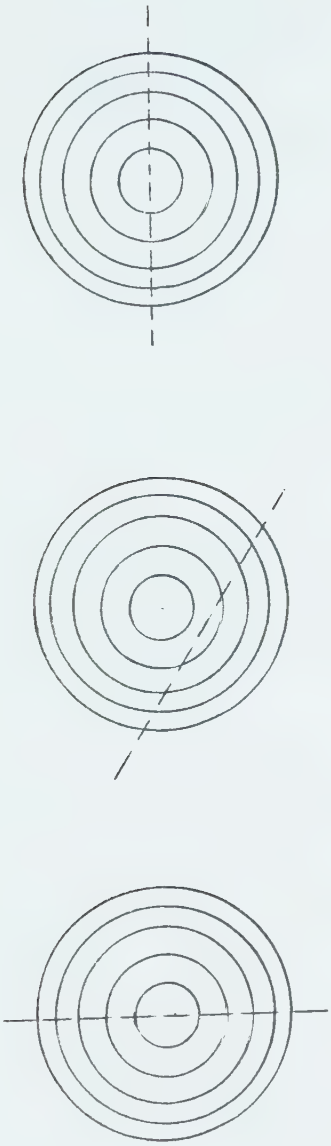
4. Helix



5. The Twist:



6. Coronet



D. Rotation and Development of Surfaces

1. You have a paper folded down the middle like a ridge roof. What will it look like if you open it out flat on the table? Draw your diagram here.

Now flatten out the folded paper. Does your diagram above look like the spread out model? ____________.

2. Now take the two tunnels. What will they look like when opened out? Draw the diagrams of what they would look like.

(a) (b)

Unfold your two tunnels and spread them flat. Did your diagram look like these? __________.

3. You can now take from the box a cylinder, cube, tirangular pyramid, rectangular pyramid, cone, pentagonal prism, hexagonal prism. Examine them carefully. Draw a picture of these as if they were opened out flat. Open out each model and spread it out flat. Did your diagram look like the model flattened out?

(a) cylinder

(b) cube

(c) triangular pyramid

(d) rectangular pyramid

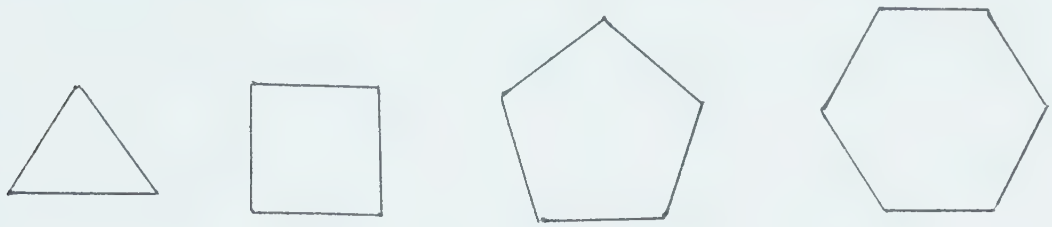
(e) cone

(f) pentagonal prism

(g) hexagonal prism

E. Polyhedra

In the box you will find the four flat shapes drawn below, and a number of solid shapes made up of these flat shapes.



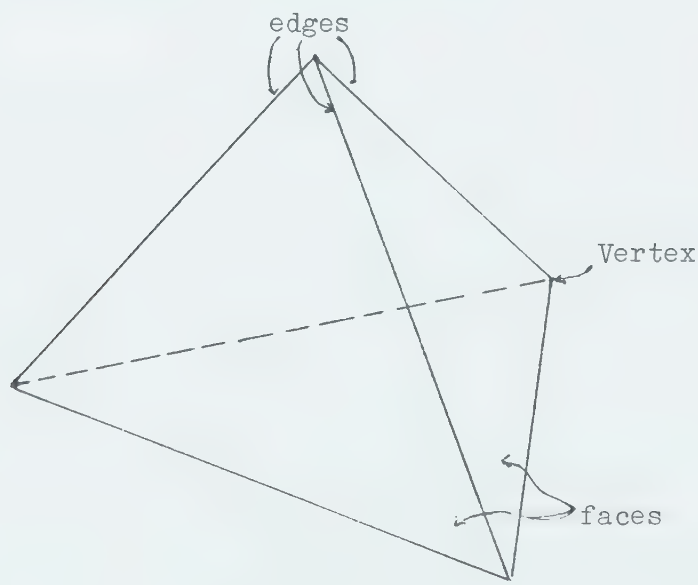
Take these four flat shapes from the box and examine them. All of the shapes are regular; that is each has equal sides and equal angles. These flat shapes are called polygons.

A triangle has _____ sides and _____ angles.

A square has _____ sides and _____ angles.

A pentagon has _____ sides and _____ angles.

A hexagon has _____ sides and _____ angles.



Now find the model of the solid figure illustrated above. It is called a tetrahedron.

How many faces does it have? _____

Any two faces meet along a line.

This line is called an edge.

How many edges are there? _____

The point where 3 or more faces meet is called a vertex.

How many vertices does a tetrahedron have? _____

There is an important rule involving the number of faces, edges, and vertices of many solid shapes called polyhedra. Examine the models of the cube, square, pyramid, octohedron, triangular prism, and hexagonal prism and complete the table below.

Name of shape	Faces	Number of Vertices	Edges	Rule?
tetrahedron				
cube				
square pyramid				
octohedron				
triangular prism				

Try to find a rule relating to the number of faces, edges, and vertices which holds for each of the above polyhedra.

The rule is given on the next page. It is called Euler's Formula.

Leonard Euler, a famous mathematician, discovered the rule. He found that in a polyhedron, the number of vertices plus faces equals the number of edges plus two.

Euler's Formula

Vertices + Faces = Edges + 2

$$V + F = E + 2$$

Check your entries in the table on the previous page by verifying Euler's Formula for each polyhedron.

Use Euler's Formula to fill in the missing numbers in the table below.

Name of Shape	Number of Faces	Number of Vertices	Number of Edges
Pentagonal prism	7	10	
Pentagonal pyramid	6		10
Hexagonal prism		12	18

Check your entries by examining the model of these three polyhedra.

Examine the pyramids and prisms again. What is the difference between a prism and a pyramid?

____

____

Examine all the models again. In what way are the cube, the tetrahedron, and the octohedron special?

____

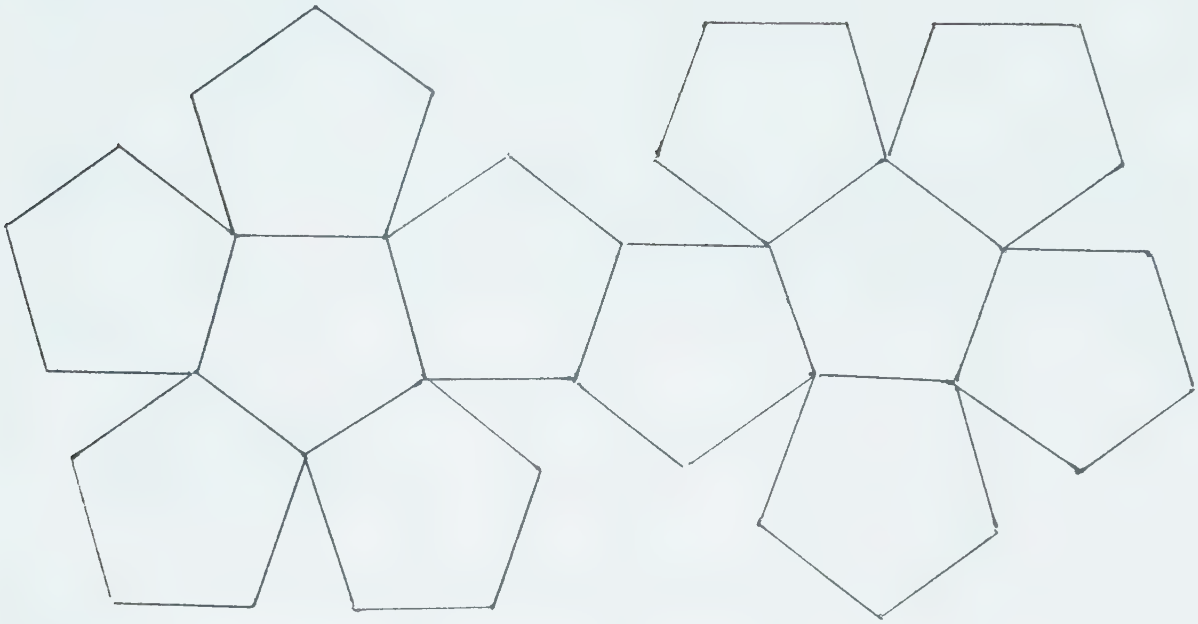
____

They are called regular polyhedra meaning that all edges, faces, and vertices are alike in every way.

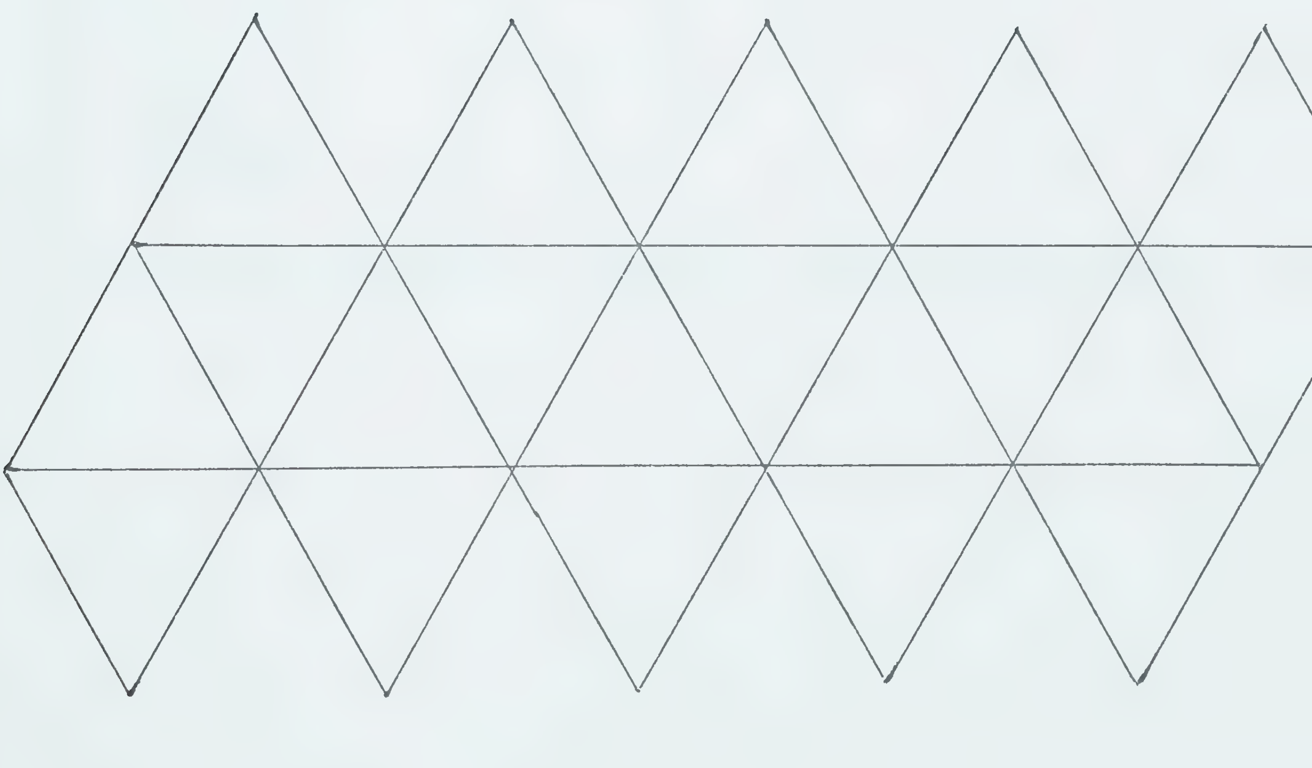
Only 5 such polyhedra are possible.

The nexts for the other two regular solid figures, the dodecahedron (_______ faces) and the icosahedron (______ faces) are found on the next page.

Regular Dodecahedron



Regular Icosahedron



Examine all the shapes again and fill in the table below on the faces of the solid shapes.

<table>
<tr><th rowspan="2">Name</th><th colspan="4">Number of Faces</th></tr>
<tr><th>triangles</th><th>squares</th><th>pentagons</th><th>hexagons</th></tr>
<tr><td><u>Pyramids</u>

tetrahedron
square pyramid
pentagonal pyramid
hexagonal pyramid</td><td></td><td></td><td></td><td></td></tr>
<tr><td><u>Prisms</u>

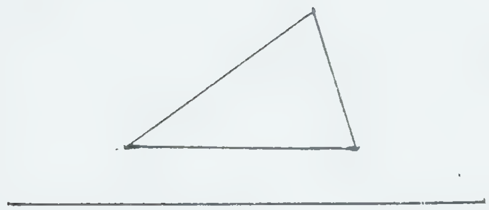
triangular prism
cube
pentagonal prism
hexagonal prism</td><td></td><td></td><td></td><td></td></tr>
<tr><td><u>Regular Polyhedra</u>

tetrahedron
cube
octohedron
dodecahedron
icosahedron</td><td></td><td></td><td></td><td></td></tr>
</table>

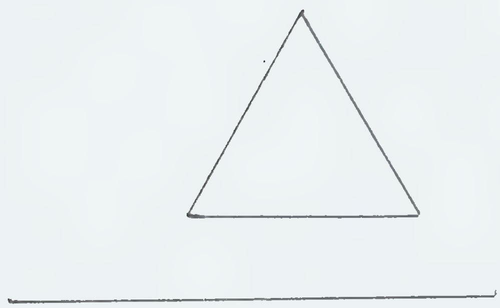
F. Similarities and Proportions

1. You are given five triangular models. Draw similar triangles which circumscribe each model using the given lines as bases.

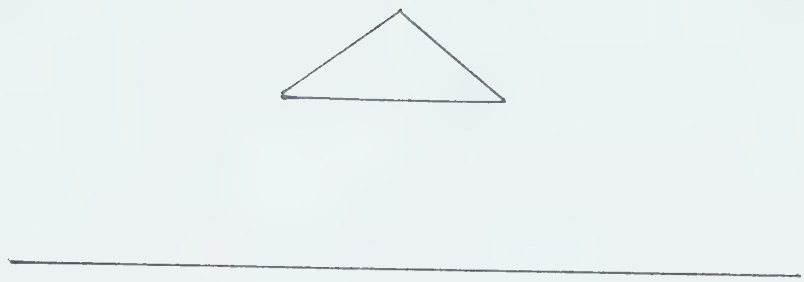
(a)



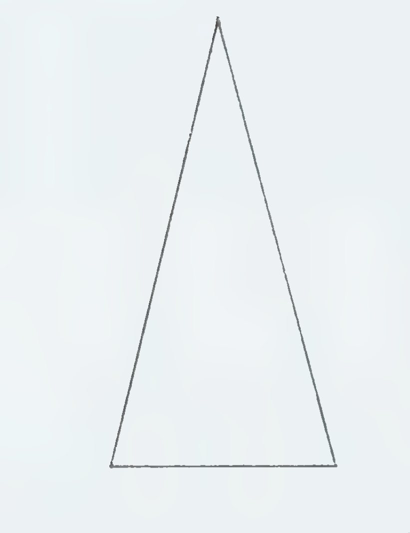
(b)



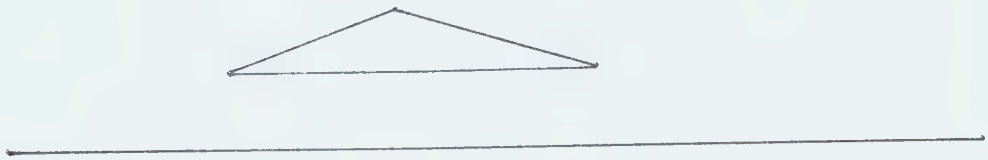
(c)



(d)

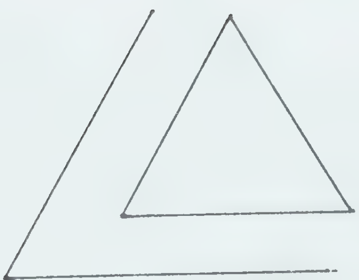


(e)

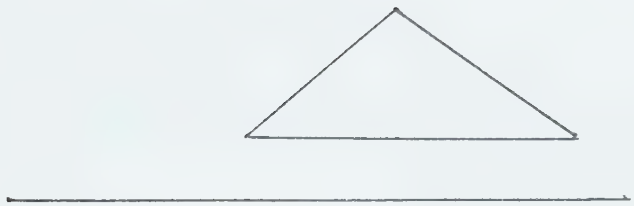


2. You have four small triangles as models. I have partially drawn two sides of each of the triangles but much larger in size. I would like you to enclose the model triangle within the two given sides by drawing the third size. Your new triangle must have twice the length of each side of your model.

(a)

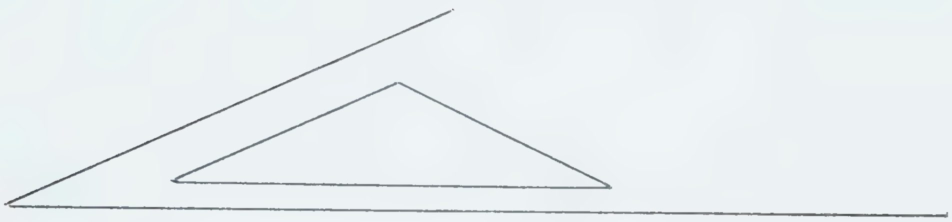


(b)

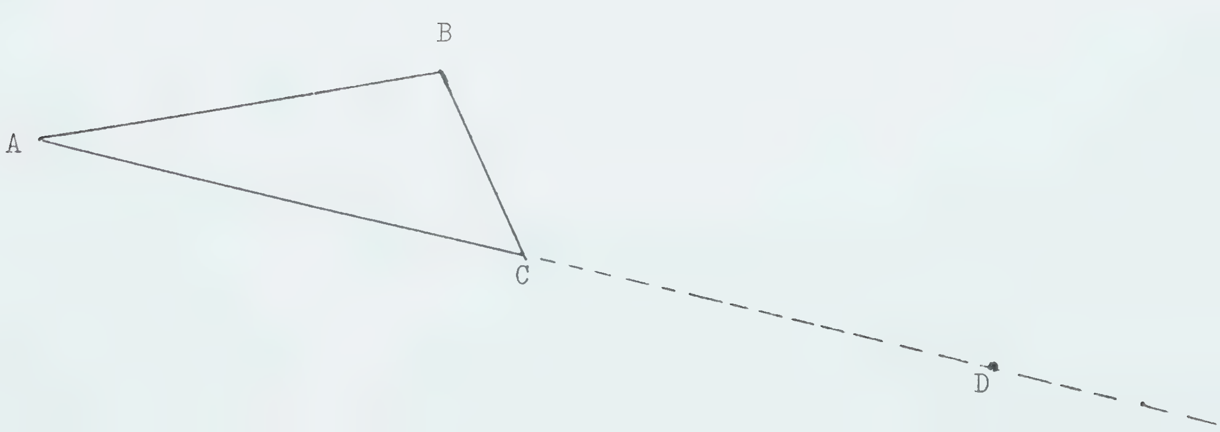


(c)

(d)

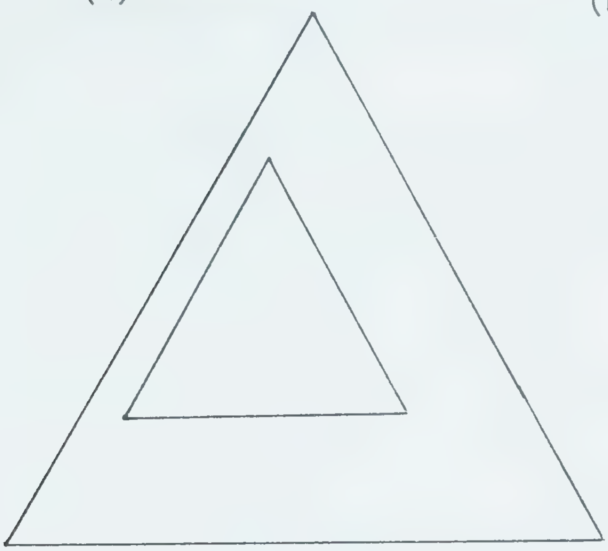


3. You are given $\triangle$ABC as a model triangle. The base AC is extended to D. Using AD as the new base, draw a triangle similar to $\triangle$ABC.

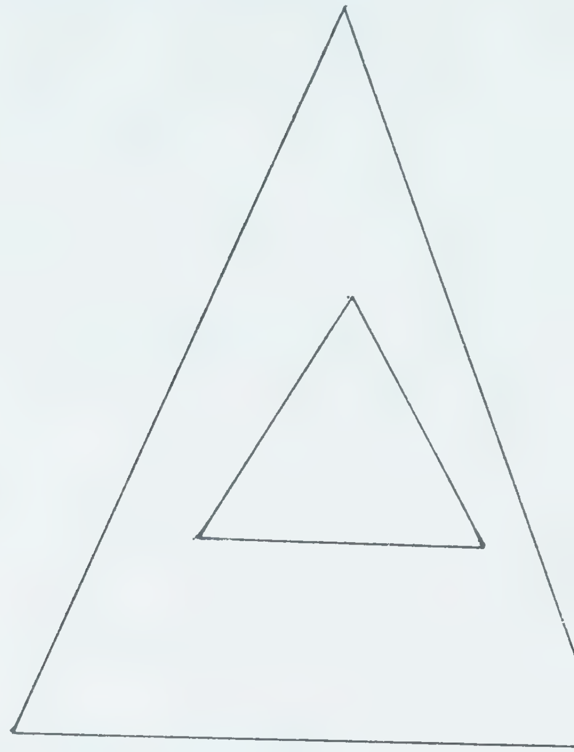


4. Decide which of the given pairs are similar and which are dissimilar.

(a)



(b)



(c)

5. In this group you have twenty-seven triangles. Will you sort them into groups depending on their shapes. State the number of groups and which triangles fall into each group.

The group of 27 triangles consisted of:

1. Five similar isosceles triangles with acute apex angles

   30 cm. sides, 9 cm. base

   20 cm. sides, 6 cm. base

   15 cm. sides, 4.5 cm. base

   10 cm. sides, 3 cm. base

   7 cm. sides, 2.1 cm. base

2. Three similar isosceles triangles with obtuse apex angles

   30 cm. sides, 50 cm. base

   15 cm. sides, 25 cm. base

   7.5 cm. sides, 12.5 cm. base

3. Three isosceles triangles, all 20 cm. heights and:

   base 5 cm.

   base 30 cm.

   base 50 cm.

4. Three dissimilar isosceles triangles, all with base 15 cm. and varying height.

   3 cm. height

   13 cm. height

   26 cm. height

5 (a) One scaline triangle: 13.5 cm., 4.5 cm. (height); 43°, 107°, 30° angles

(b) One isosceles triangle 12 cm. base, 6 cm. height, 45°, 45°, 90° angles

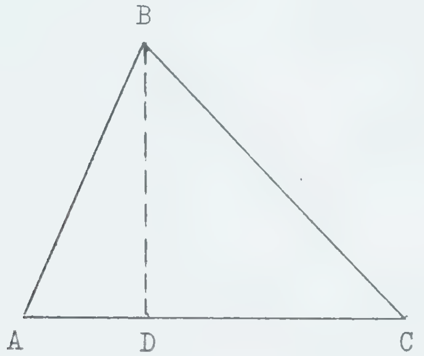
(c) One equilateral triangle 8 cm. base.

(d) One right-angled triangle 16.5 cm. base, height 8.5 cm. and angles 28°, 62°, 90°.

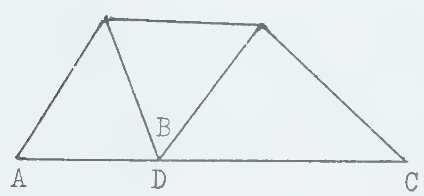
6. Eight equilateral triangles and a triangle with the same apex angle but with the base cut at a different angle.

G. Paper Folding

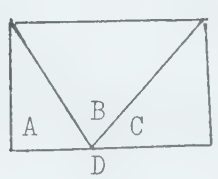
You are given $\triangle$ ABC with altitude BD. Cut it out. Fold the altitude BD of the given triangle ABC.

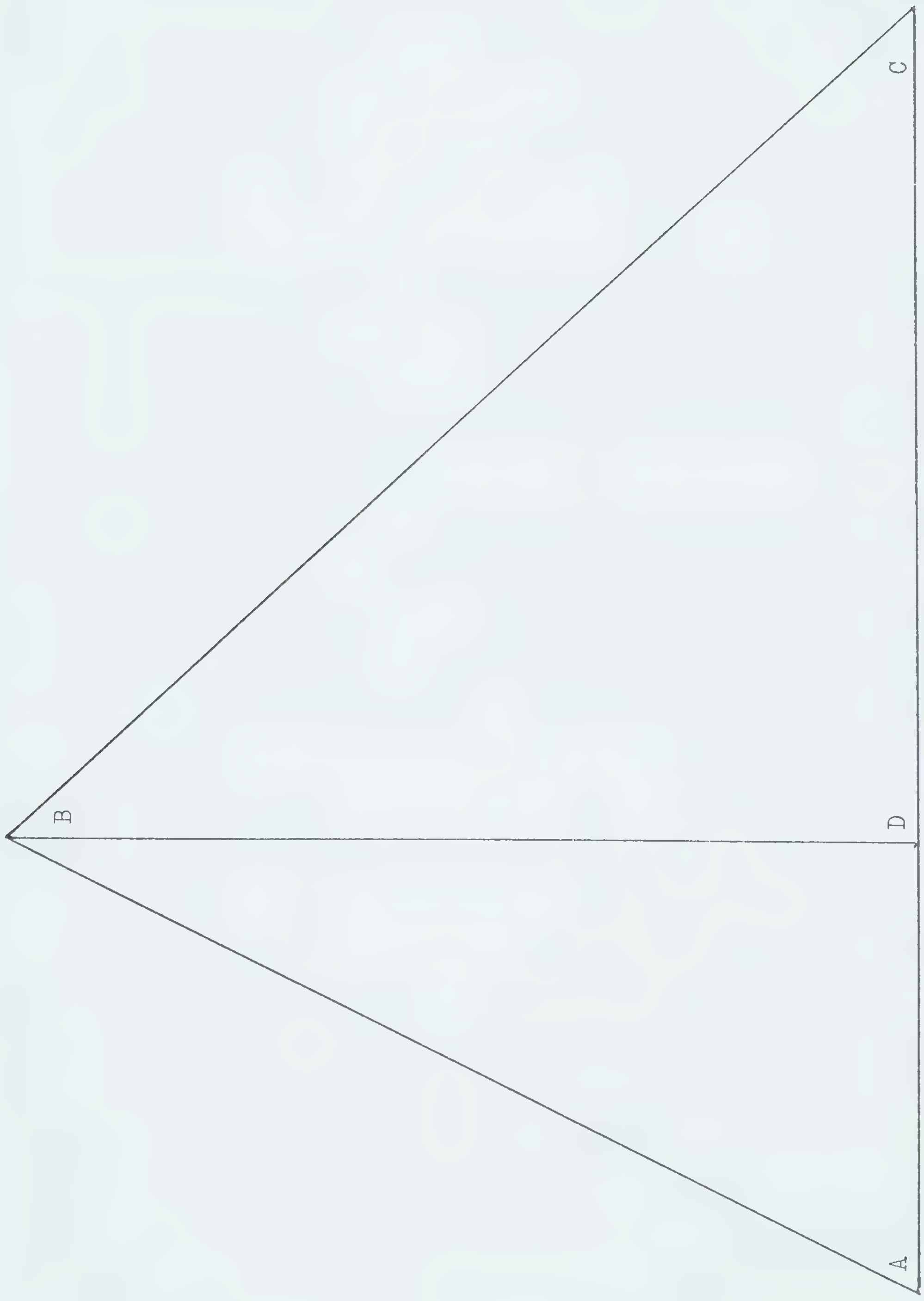


Fold the vertex of the triangle B upon the base of the altitude D.



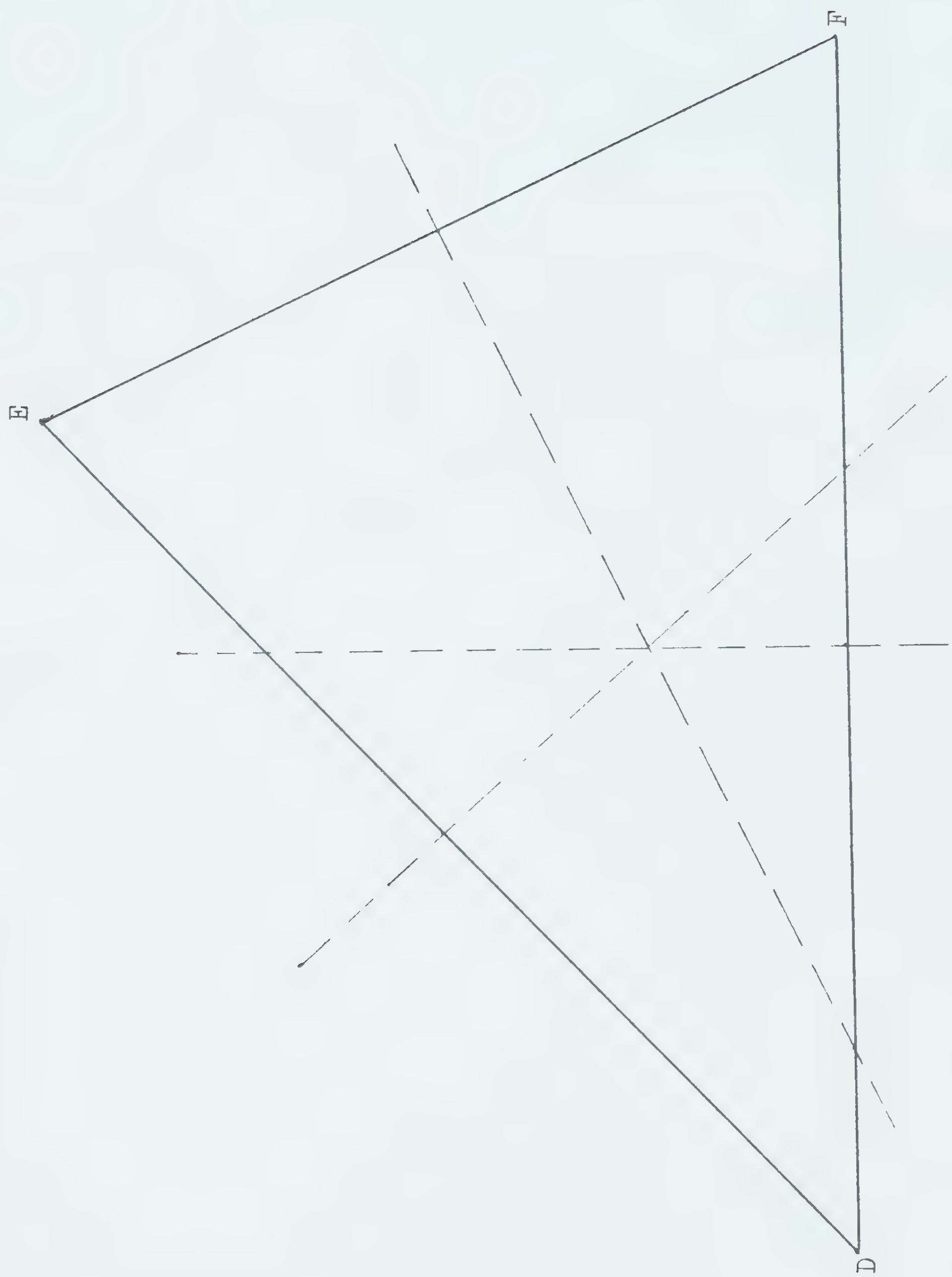
Fold the base angle vertices A and C to the base of the altitude D. Does $\angle$A + $\angle$B + $\angle$C make up a straight angle? What is the sum of $\angle$A, $\angle$B, and $\angle$C? __________.




C
B
D
A

2. You are now given $\triangle$DEF with the perpendicular bisectors of each side. Cut it out. What is the common point of intersection of these lines called? ______________ Fold creases from this point to each vertex of the triangle. Compare these lengths.

3. You now have $\triangle$HJK. Bisect the three sides of the given triangle. Cut it out. Fold the crease from the midpoint of each side to the opposite vertex. What is this common point of intersection called? ______________.
How do the distances from the point of intersection of two medians to each vertex of the triangle compare? ______________
Try balancing the triangle by placing it on a pin at the intersection of the two medians. What is this point called?
______________.


F
E
D


J
H

4. Cut out your circle. Locate the center O of the circle by folding two diameters. Fold the circle along a diameter AD. While folded, fold a portion of the circle forming two equal chords, AB and AC. How do the arcs AB and AC compare? ______________. Fold radii BO and CO to form the central angles AOB and AOC. Compare the central angles by superposition. Fold the perpendicular bisector BO and FO of chords AB and AC. Compare lengths BO and FO by superposition. What generalizations can you state about equal chords and equal arcs of the same circle?

5. Cut out another circle. Fold any chord LM. Fold diameter NP perpendicular to this chord. How do the segments of the given chord LE and EM and the subtended arcs LN and NM compare?

State the principle you discovered in each of the five questions.

1.

2.

3.

4.

5.

APPENDIX 3

TEST 1 SECTION A

Triangular Prism	1.	transverse
	2.	longitudinal
	3.	oblique
	4.	parallel
Parallelpiped	5.	parallel
	6.	oblique
	7.	transverse
	8.	longitudinal
Cube	9.	oblique
	10.	transverse
	11.	longitudinal
	12.	parallel
Cone	13.	longitudinal
	14.	parallel
	15.	transverse
	16.	oblique

TEST 1 SECTION B

Cube	1.	oblique
	2.	longitudinal
	3.	transverse
	4.	parallel
Triangular Prism	5.	parallel
	6.	oblique
	7.	longitudinal
	8.	transverse

Cone	9.	transverse
	10.	longitudinal
	11.	oblique
	12.	parallel
Parallelpiped	13.	longitudinal
	14.	parallel
	15.	oblique
	16.	transverse

TEST II SECTION A

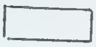
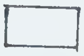
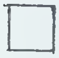
Rectangular Solid	1.	transverse
	2.	longitudinal
	3.	oblique
	4.	parallel
Cylinder	5.	parallel
	6.	oblique
	7.	transverse
	8.	longitudinal
Star	9.	longitudinal
	10.	oblique
	11.	parallel
	12.	transverse
Pyramid	13.	parallel
	14.	transverse
	15.	longitudinal
	16.	oblique

TEST II SECTION B

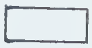
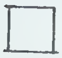
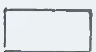
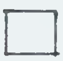
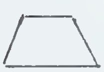
Star	1.	parallel
	2.	oblique
	3.	longitudinal
	4.	transverse
Rectangular Solid	1.	longitudinal
	2.	oblique
	3.	parallel
	4.	transverse
Pyramid	1.	oblique
	2.	parallel
	3.	longitudinal
	4.	transverse
Cylinder	1.	transverse
	2.	longitudinal
	3.	oblique
	4.	parallel

CORRECT RESPONSES

Pretest:

Section A		Section B	
1.		1.	C
2.		2.	E
3.		3.	A
4.		4.	B
5.		5.	E
6.		6.	F
7.		7.	A
8.		8.	B
9.		9.	A
10.		10.	B
11.		11.	B
12.		12.	B
13.		13.	A
14.		14.	A
15.		15.	B
16.		16.	A

Postest: Section A / Section B

Section A		Section B	
1.		1.	b
2.		2.	c
3.		3.	b
4.		4.	b
5.		5.	a
6.		6.	a
7.		7.	a
8.		8.	e
9.		9.	b
10.		10.	a
11.		11.	b
12.		12.	c
13.		13.	f
14.		14.	e
15.		15.	c
16.		16.	e

APPENDIX 4

TOTAL POPULATION

CELL MEANS

	7	8	9	Total
No lab	15.43	11.46	20.31	47.20
Lab	20.44	21.11	27.00	68.55
Total	35.87	32.57	47.31	115.75

SUMMARY OF INTERACTION ANALYSIS

Source of Variance	SS	df	MS	F	P
A (no lab vs lab)	4864	1	4864	125 (6.64)	.01
B (grades)	4160	2	2080	53.3 (4.60)	.01
AB	0	2	0	0 (4.60)	.01
Within Cell	15960	410	39		

The calculated F-ratio exceeds the tabled F-ratio of 6.64 for A. Therefore the hypothesis is rejected for the total population.

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